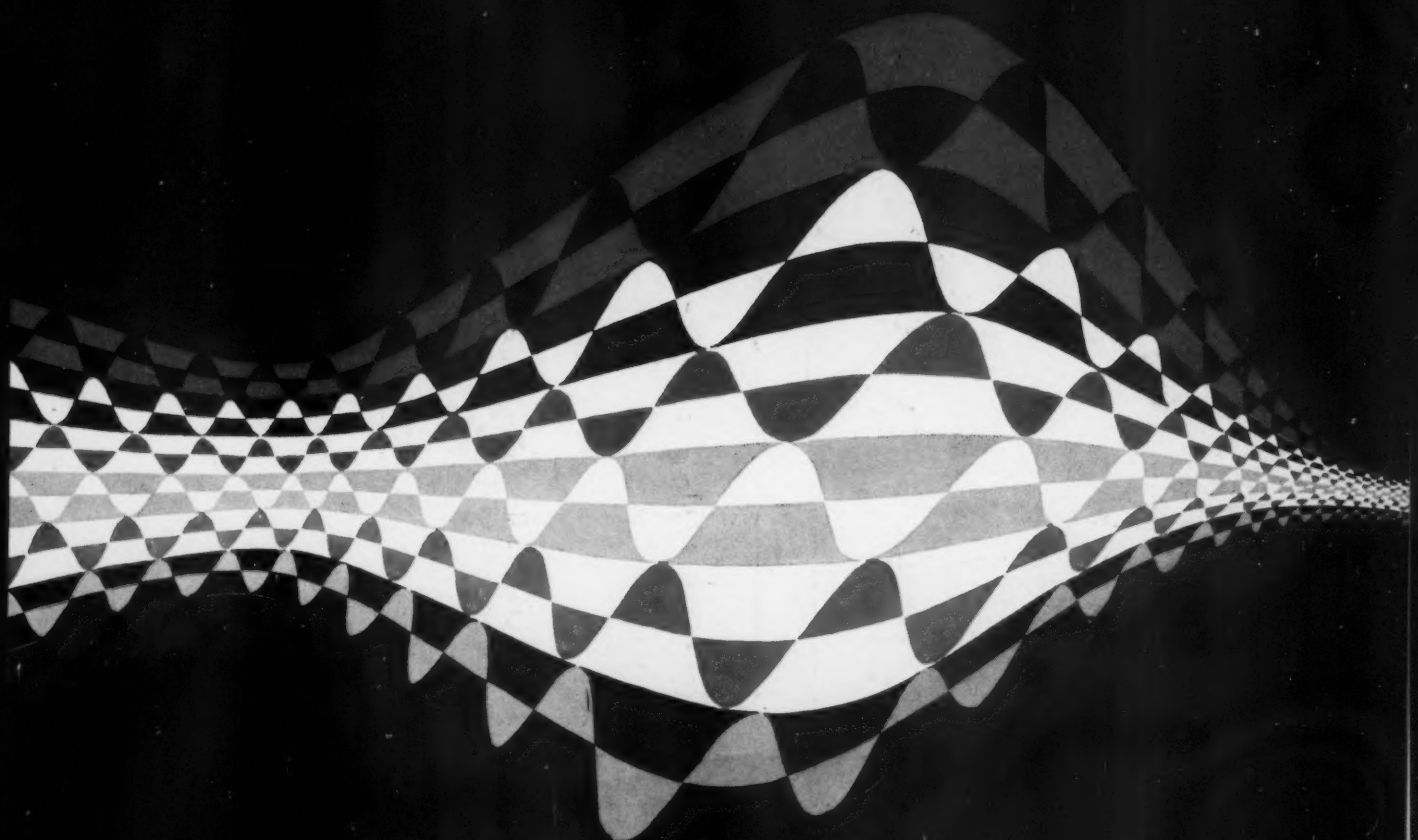


G.E.C.

FOR TRANSFORMERS—rely on the experience of G.E.C.

More advantages

A TYPE APPLICABLE TO EVERY INDUSTRY

in Mark II SNAP-LOCK heavy duty limit switches

WATER
OIL
AND
DUSTPROOF
OR
FLAMEPROOF
VERSIONS

Now

TWO ONLY
REPLACEABLE UNITS IN THE ELECTRICAL SIDE

There are only two assemblies in the electrical side of B.S.A. ACME SNAP-LOCK Mk. II limit switches: a moulded one-piece contact block and the contact arm. Interchangeable on all models they are designed for easy replacement. Service kits comprising these items, complete with holding nut and fixing screws, are supplied at moderate cost.

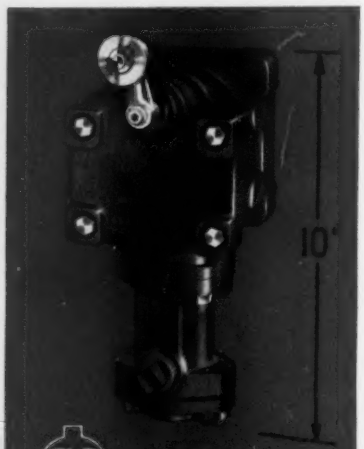
B.S.A. Acme Snap-Lock heavy duty limit switches have an established reputation for reliability under the most arduous conditions. Recently introduced Mark II versions retain proved features of their forerunners but incorporate refinements in design and manufacture principally to simplify servicing, provide complete interchangeability of assemblies, increase electrical resistance to earth and ensure lasting efficient sealing. Please ask for the Mark II catalogue.

STANDARD

WATER, OIL & DUST PROOF

Single pole, double break, double throw, operates with either circuit normally open with other closed, or maintaining in either position, or available with central (neutral) position and/or centre connection. Heavy aluminium die-cast case. Water, oil and dust proof. Conduit ¾ in. B.S., or No. 3 Admiralty Pattern Cable gland entry. Two-screw side mounting or backplate mounting in two styles, or Tandem style (back to back mounting). Operating lever position adjustable in 7.5 deg. increments through 82.5 deg. either way from normal.

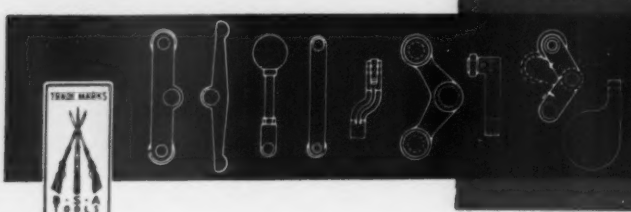
STANDARD NEUTRAL POSITION OR CENTRE CONNECTION



FLP FLAMEPROOF

SINGLE OR DOUBLE ENTRY

Buxton certificates No. 3574 (Group I) No. 3575 (Groups II and III gases). Meehanite iron castings. Self wiping solid silver contacts, interchangeable plugs and sockets. Internal mechanism removable as a unit for servicing. **Single SWA cable entry (standard); double entry if required.** *Operating lever position adjustable in 7.5 deg. increments through 360 degs. Single pole, double break, having one normally closed and one normally open circuit. Available with central (Neutral) position and/or centre connection.*



A few examples from the range of more than 30 styles (over 150 sizes) of interchangeable operating levers. List on request.

Made in England under Licence by B.S.A. TOOLS LIMITED, BIRMINGHAM 33

Sole Agents U.K.

BURTON GRIFFITHS & COMPANY LIMITED
SNAP-LOCK DEPT., MONTGOMERY STREET, BIRMINGHAM, 11
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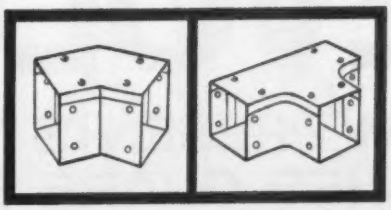
B.S.A. SNAP-LOCK ACME

463

Power Centre trunking fittings. Precision made Speeds the job of installation. Layout extension or alteration made easy Shown right, H.E.T. Half Normal Bend and Normal Tee.



it's what you
don't see
that makes
Power Centre Trunking
so durable

ELECTRICAL DIVISION

POWER CENTRE

Poor J.B., he's been hanging around for days. Never said a word to anyone. Doc says it's trunking problems. "He needs a tonic", he said. So Doc, who gets to the bottom of everyone's troubles, prescribed Power Centre, the people who make jig made trunking that's got a hidden coating of zinc which ensures long lasting protection. This P.C. treatment has re-vitalised J.B. Already, he's feeling on top of the world with the satisfaction of knowing he can cut installation costs by as much as 33⅓%.
J.B. is a different person now, thanks to Power Centre. What's more, he fully recommends a dose of P.C. to anyone who's suffering from trunking problems.

If you're in this unnecessary predicament, take the first step to satisfaction by sending for P.C.'s fully descriptive literature.

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Telephone: Wednesbury 1311.

Stocks in all Simplex Branches throughout the country.

A

REVOLUTION!

OSRAM PRESENTS THE NEW FILTA-LITE BANISHES GLARE BRIGHTENS PROFITS

1. This unique bulb is coated inside with titanium dioxide on a specially prepared surface to reduce glare and give maximum light efficiency.

2. There are new bulb sleeves and zipper cases—which can be used as self-service units—all colour-coded for immediate wattage identification.

3. Hundreds of TV commercials and fortnightly press advertisements will bring customers to you for the revolutionary new Osram Filta-lite.

The Romans too had a word for it. . .

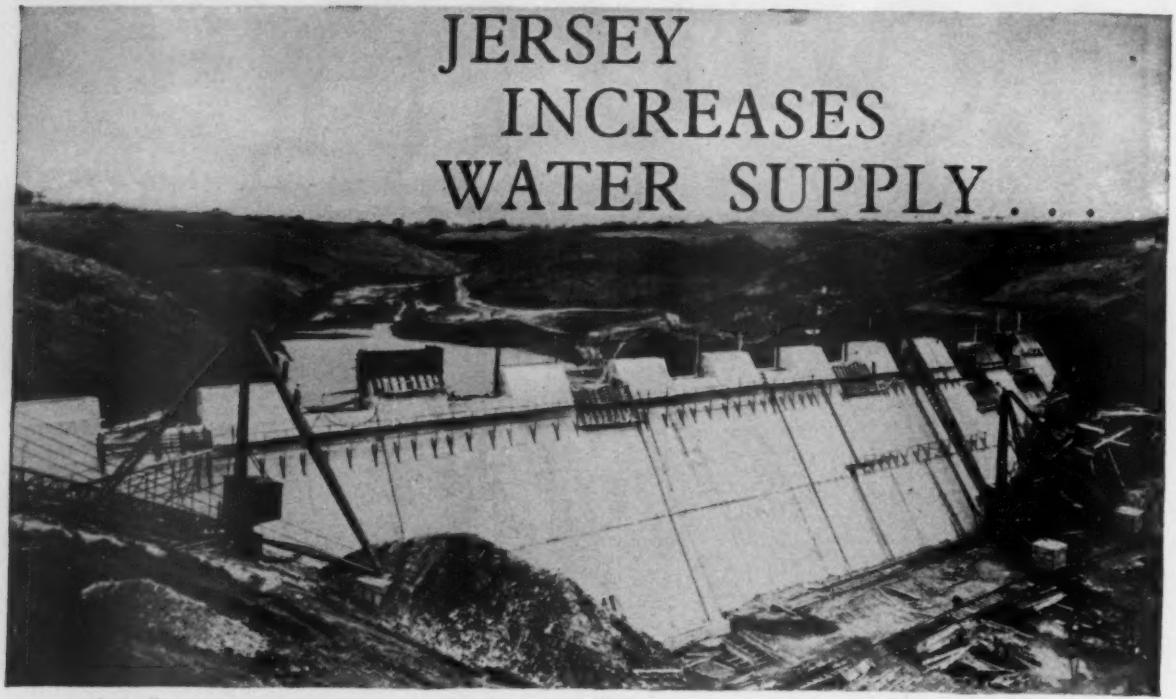
As a matter of fact, they had three words for it. So have we, but they are not the same. To the Romans, PARVALUX meant "Light But Little". To us, it means Fractional Horse-power Motors—and that is what it means to our numerous customers, organisations whose names are known the world over. And so, of course, the name PARVALUX is known all over the world, too. When we are asked to build a machine, years of skill and craftsmanship go into its construction. That is why intricate specifications never worry us. We also have a very extensive range of standard f.h.p. motors and gear units, with horsepowers varying from 1/300 to 1/5, yet even these can be modified to suit any customer's special requirements. If PARVALUX also meant "versatile", we should not be at all surprised.

Fractional Horse-power Motors by...

REGISTERED TRADE MARK
PARVALUX
LIMITED

PARVALUX ELECTRIC MOTORS LTD · WALLISDOWN RD · BOURNEMOUTH · HAMPSHIRE · *Tel : Winton 4983/4 · Grams : Parvalux Bournemouth*

JERSEY INCREASES WATER SUPPLY . . .

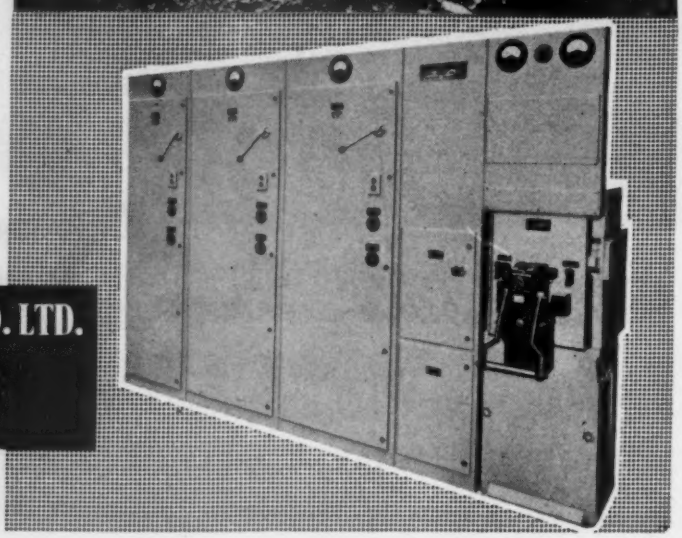


with two new reservoirs

"Erskine Heap" switchgear controls the pumping

Two new reservoirs have been built at Val de La Mare and La Hague and in both cases the pumping is controlled by Erskine Heap Switchboards. The reservoir capacity is 220 million gallons. Pumping rate 150,000 gallons/hr against a 300ft head. The dam is a gravity type, spillover without free board and 50,000 cubic yards of concrete was pumped into position. Total cost of entire project was £600,000.

The Switchboard illustrated on the right is the one manufactured for the Val de la Mare Reservoir Pumping Station, and is similar to that being supplied for La Hague. The multi motor contactor type Switchboard comprises incoming ASTA certified oil circuit breaker unit, the Pump control units each being 160 HP auto transformer starters.



CONSULTING ENGINEERS.
Messrs. T. & C. Hawksley, Westminster.

CONSTRUCTORS OF DAM AND INSTALLERS OF PUMPING PLANT AND MAINLAYING.
The Jersey New Waterworks Co. Ltd.

Engineer and Manager:
Mr. Robert Burrow, M. Inst., W.E.

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SWITCHGEAR SPECIALISTS

Branch offices and agencies in all parts of the world

HEAD OFFICE & WORKS:—
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739

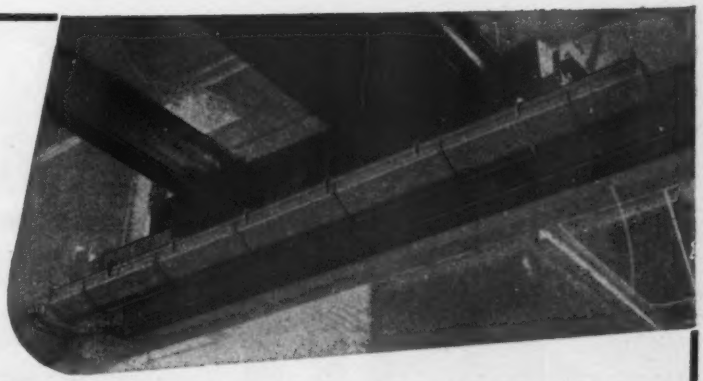
A NEW NAME MEANING

COMPLETE SAFETY IN

POWER SUPPLIES TO

TRAVELLING

CRANES



Manguard

SAFETY SUPPLY SYSTEM
Patent No. 861073

PRINCIPLE

The principle of Manguard is the provision of a set of flexible bar collectors on the crane and electrically protected contact boxes at intervals along the crane track connected by insulated cable.

SAFETY FEATURES

- Contact box spacing ensures an electrical supply to the crane at all times.
- Each contact box has its own contactor ensuring that the contact studs are alive only when in contact with the crane collector bars.
- The crane collector box is fabricated in fibreglass. The four contact bars are bedded in flexible polyurethane, giving long life and minimum maintenance.
- Isolation of any section may be readily carried out.
- MANGUARD equipment may be fitted to existing cranes.

D. BERGUE MACHINE TOOLS LIMITED
WEST GORTON, MANCHESTER 12
TELEPHONE: EAST 2771 (6 LINES) TELEGRAMS: DEBERGUE, MANCHESTER

REF. 1105

Cut CONTROL GEAR ASSEMBLY COSTS with—

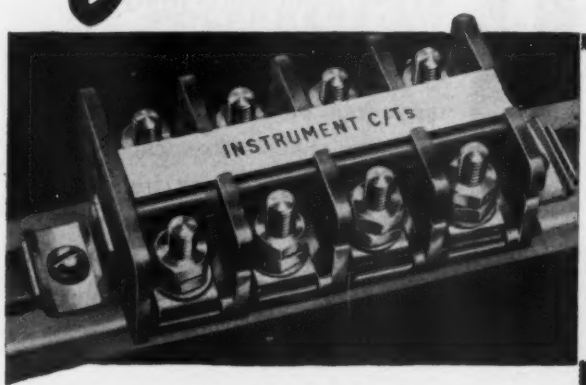
BETA

TERMINAL BLOCKS

now available in

Moulded Nylon

with smaller dimensions



The Beta Terminal Block has been designed for the simple and economical grouping of any number of ways. Extra ways can be inserted without dismantling or further drilling. Only two fixing screws are required up to 12 ways. Provision is made for numbering each way individually or in groups. Transparent covers are available if required.

Moulded from Nylon, giving high mechanical strength and vastly increased resistance to tracking. Fitted with 2 B.A. phosphor-bronze studs and brass connecting link. Suitable for currents up to 20 amps at 660 volts. APPROVED BY CENTRAL ELECTRICITY GENERATING BOARD.

CRITCHLEY BROS · LTD

BRIMSCOMBE · STROUD · GLOS · Tel: BRIMSCOMBE 2208 (3 lines)

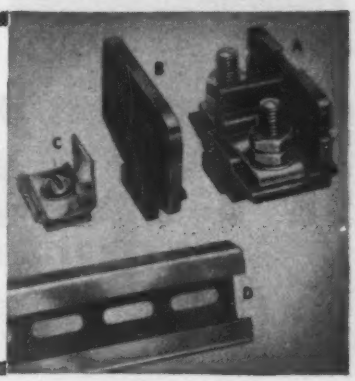
BASIC UNITS

A Body in moulded Nylon with brass connecting link and 2 B.A. phosphor-bronze studs.

B Moulded Nylon barrier. Required only at one end of group.

C Cadmium plated steel end clamp, one required at each end of group.

D Cadmium plated slotted steel channel.



FROM ALUMINIUM

MORE ADVANTAGES

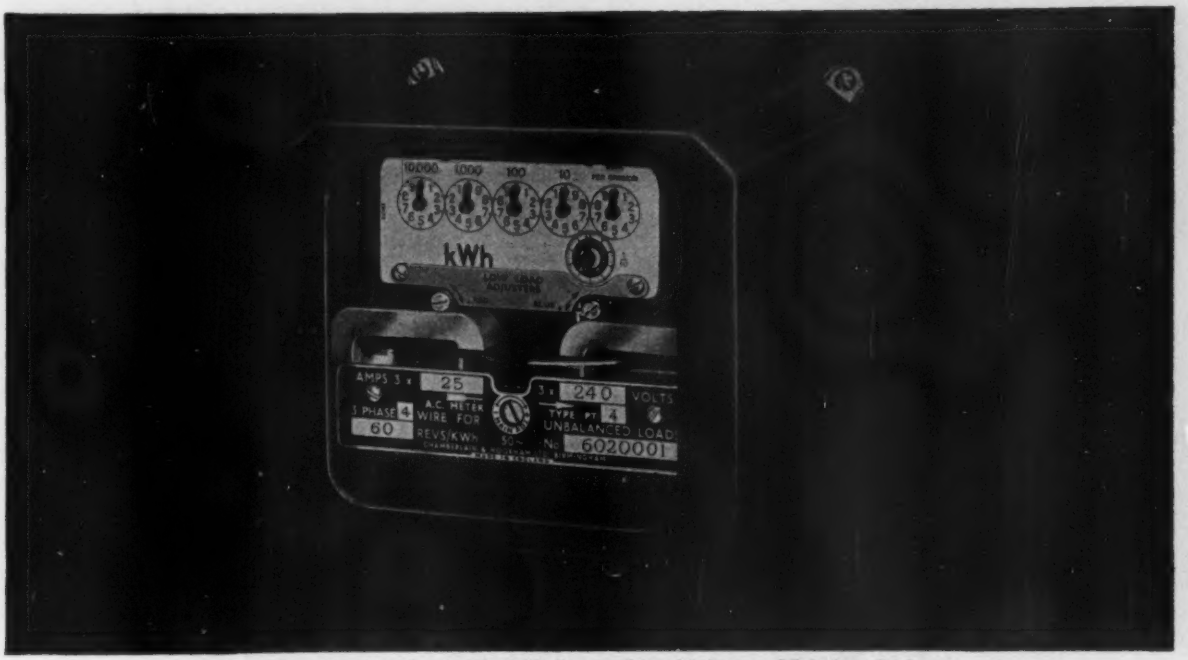
There are many applications in electrical engineering where a combination of light weight, ductility and good electrical properties offers obvious advantages. Already, aluminium is being widely used for conductors and structural components. Applications range from busbars to radio and television chassis, from cable sheathing to fan blades, from transmission lines to thermionic valve screens. And remember that many direct uses of aluminium bring important secondary economies.

impalco aluminium

Imperial Aluminium Company Limited · Birmingham

choose C. & H. meters

for high performance in a compact size



C. & H. *P series of meters in light alloy or all-insulated cases. PT 3-phase 3-wire. PT4 3-phase 4-wire. 5, 10, 25 and 50 amperes.*

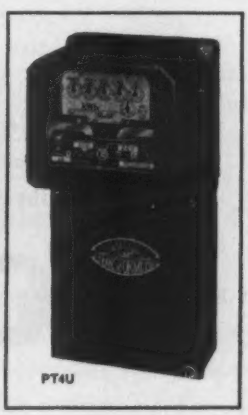
POLYPHASE-SINGLE DISC TO BS37 Parts 1 & 4

There is a Chamberlain & Hookham meter for every purpose and every situation. These are the widely used P series of meters with single disc, specially designed to reduce errors due to interaction. Like all C. & H. meters they provide high performance in a compact size.

TRANSFORMETERS

C. & H. P type "transformeters" are of light alloy or all-insulated construction with steel transformer cases. PTU 3-phase 3-wire. PT4U 3-phase 4-wire. 100, 150, 200 and 300 amperes.

PTU


PT4U

CHAMBERLAIN & HOOKHAM LIMITED

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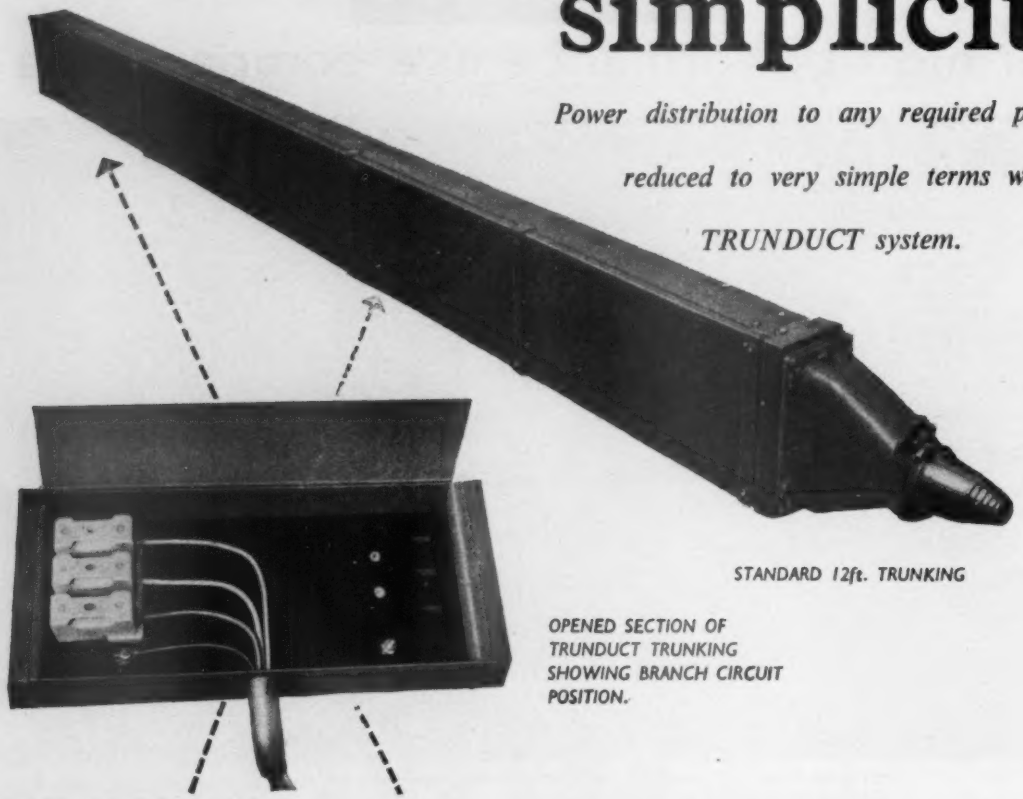
TRUNDUCT

simplicity

Power distribution to any required point is reduced to very simple terms with the TRUNDUCT system.



STANDARD 12ft. TRUNKING

OPENED SECTION OF TRUNDUCT TRUNKING SHOWING BRANCH CIRCUIT POSITION.

TRUNDUCT ADVANTAGES IN LONG OR SHORT TERM PLANNING

Copper busbars used in a new economical manner are carried within standard lengths of steel ducting. Spaced along each length are four branch circuit positions which contain the necessary fuses plugged direct on to the main bus-bars. Tapping-off boxes are eliminated. This system provides much more efficient use of the bus-bars, cuts out potential sources of contact and earthing troubles normally associated with tapping-off boxes, provides easier methods of installation, saves time on planning, ordering and installation and offers the easiest possible way for balancing phases. In whatever way the system is installed it presents a clean streamline appearance.

You should investigate the **TRUNDUCT BUSBAR DISTRIBUTION SYSTEM**

Write now for a fully illustrated folder giving details of main power distribution 200-600 amps, small power distribution up to 125 amps and rising main distribution.

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GLASGOW OFFICE: 125 WEST REGENT STREET, GLASGOW

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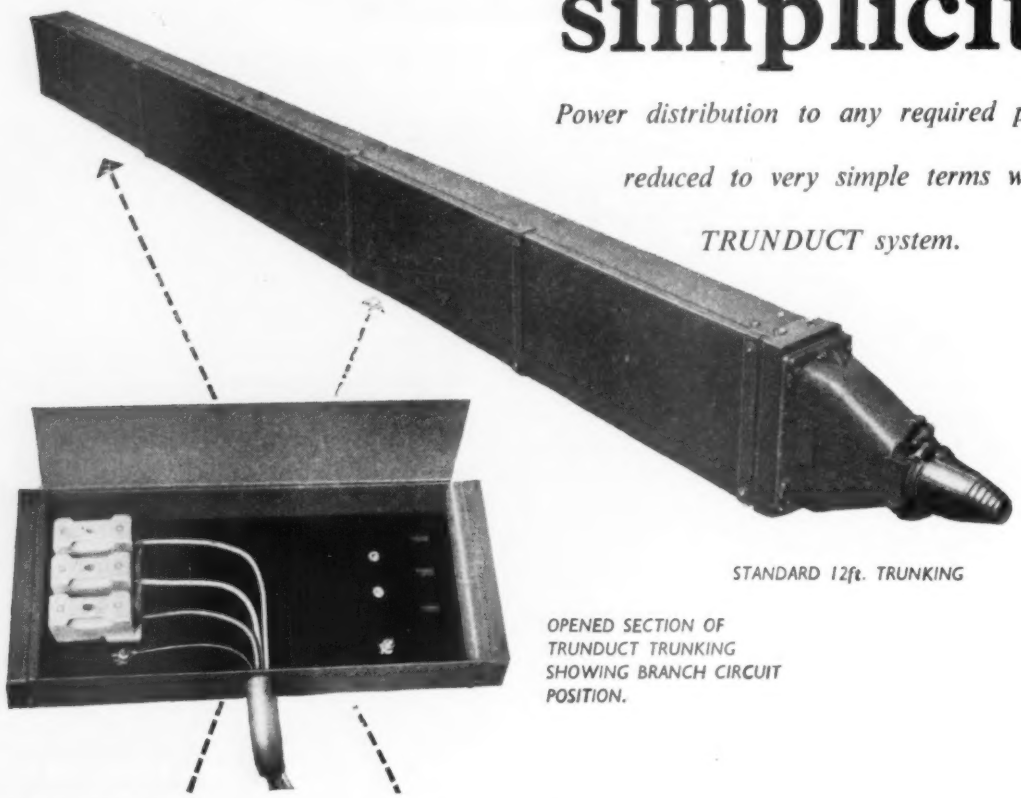

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OVERSEAS—British Columbia takeover approved, directors say compensation inadequate . . . New Brunswick cuts rates from 6%-25% . . . Egypt tests first nuclear reactor . . . In Pakistan, power shortage anticipated by 1965, ninefold increase in production since independence . . . India plans Durgapur expansion . . . In Australia, Tallawarra 320 MW station fully commissioned; proposed Hazelwood station will have 1,200 MW capacity. (244, 245)

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H.R.C. FUSE FITTINGS

Providing GREATER SAFETY to operating personnel

RATINGS: 15, 30, 60 & 100 AMPS—500 VOLTS
NORMALLY AVAILABLE EX STOCK

SAFETY FEATURES

- When the fuse carrier is removed from the base no 'live' metal is exposed, the base contacts being enclosed by insulating shrouds.
- The fuse carriers and bases are so designed that however a fuse carrier is held while it is being withdrawn or inserted, it is impossible for 'live' metal to be touched.
- Front connected fuse bases are provided with insulating sleeves to give protection should the insulation on the cable be stripped back too far.
- The shroud over the fuse terminal can be removed without disturbing the shroud over the fuse contact connected to the supply, permitting spare circuits to be cabled in safety.

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FG.65

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ERA increases charges for use of network analyser. New scale for routine problems, £45/day for members, £60/day for others. (239)

BUSINESS—Mullards acquire Associated Transistors (239) . . . Creditors of Clydesdale, Scottish retailer, reject offer of 5s in the £1 (240) . . . Carbon Electric Holdings formed to take over MB Metals and Nobrac Carbon (242) . . . Atlas Lighting has an encouraging start to current year . . . Richardsons, Westgarth centralise control, and concentrate on land power units . . . John Brown Land Boilers say consortium with Foster Wheeler is working "well and happily" . . . Cable and Wireless lift earnings by £1 million and raise dividend . . . English Electric declare steady 3% interim, but Christy Bros. lift dividend. (246) . . . Ekco form new export Co. (241) . . . Plessey buy Philco's interest in Semiconductors Ltd. (239)

OVERSEAS—British Columbia takeover approved, directors say compensation inadequate . . . New Brunswick cuts rates from 6%-25% . . . Egypt tests first nuclear reactor . . . In Pakistan, power shortage anticipated by 1965, ninefold increase in production since independence . . . India plans Durgapur expansion . . . In Australia, Tallawarra 320 MW station fully commissioned; proposed Hazelwood station will have 1,200 MW capacity. (244, 245)

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NORMALLY AVAILABLE EX STOCK

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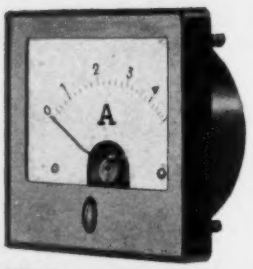

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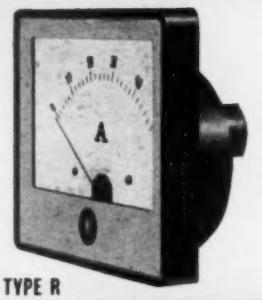

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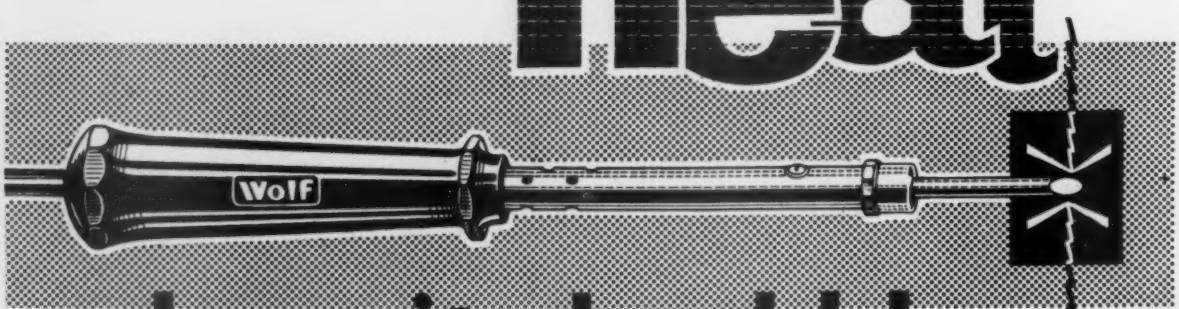

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TYPE 92 Take a long, close look at the Wolf 92 Soldering Iron, at the perfect balance, solid construction, quality finish, functional elegance which suggest fast, easy, economical soldering. Try the Wolf 92 on your next job. See how quickly the tip heats up, how the working heat remains constant right through the job. That's because Wolf heating elements put heat where it should be, right at the working tip. You'll do a good job better with the Wolf 92.

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Overall cover protects rotary mechanism. Coil spring controls silver-faced contacts. Normal usage cannot put switch in inoperative position nor contacts in partial engagement. Nylon switch actuator. Recessed base; 2 in. fixing centres.

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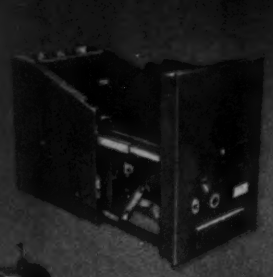

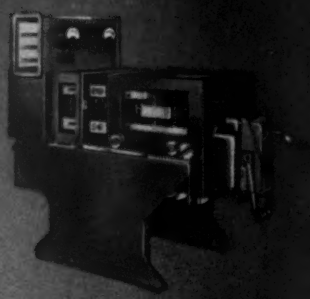

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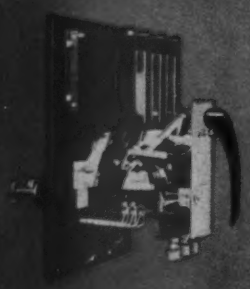

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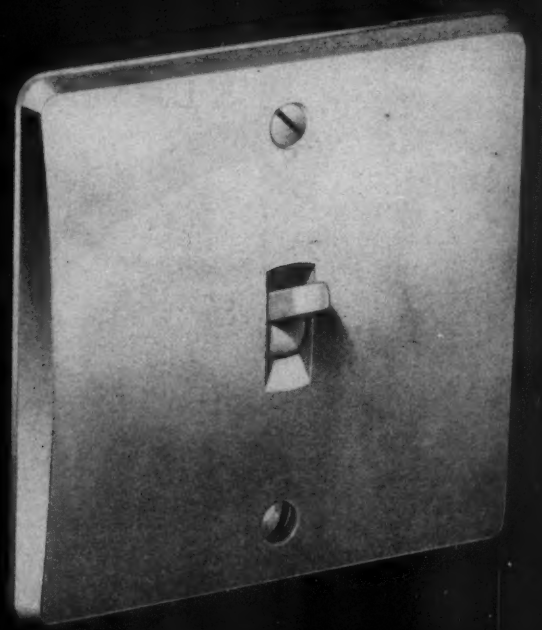

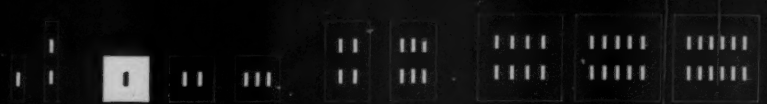

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If you listen hard enough you *may* just hear the discreet whisper of a 'Mutac Clipper'.

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5 amp 2 way S.P.
5 amp 2 way & off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
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Blanking Unit

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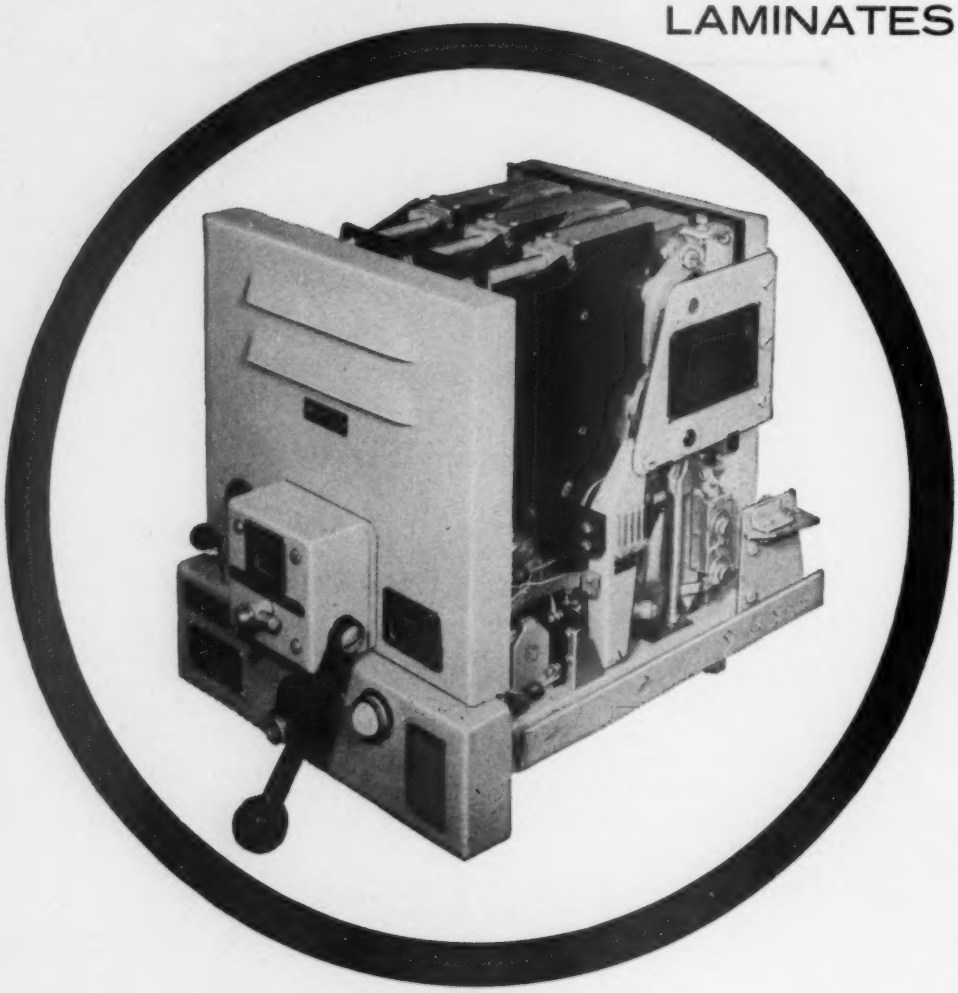

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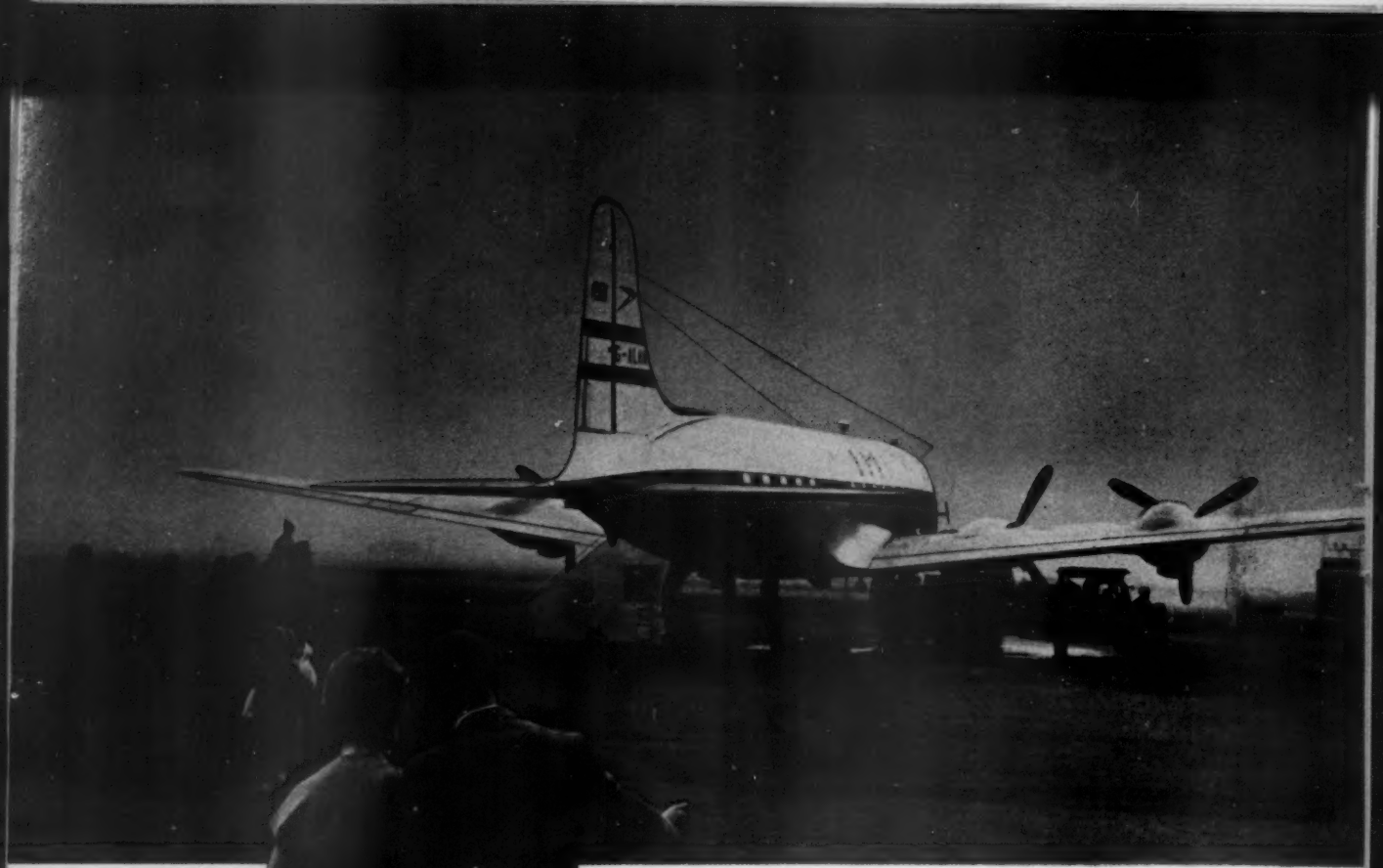

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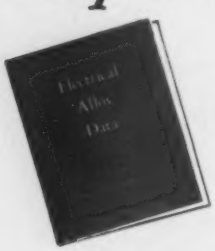

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lightweight sections interlock without visible joints

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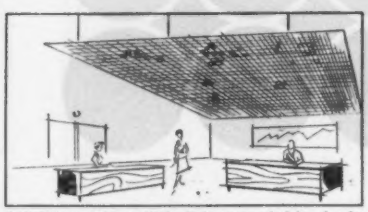

Infinilite weighs so little, it is suspended by slender wires only. No T beams.

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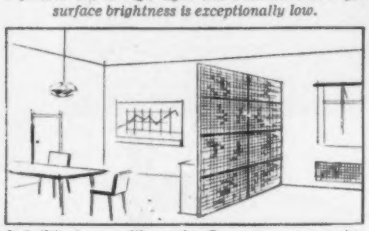

Infinilite is versatile and offers numerous design and decorative possibilities.

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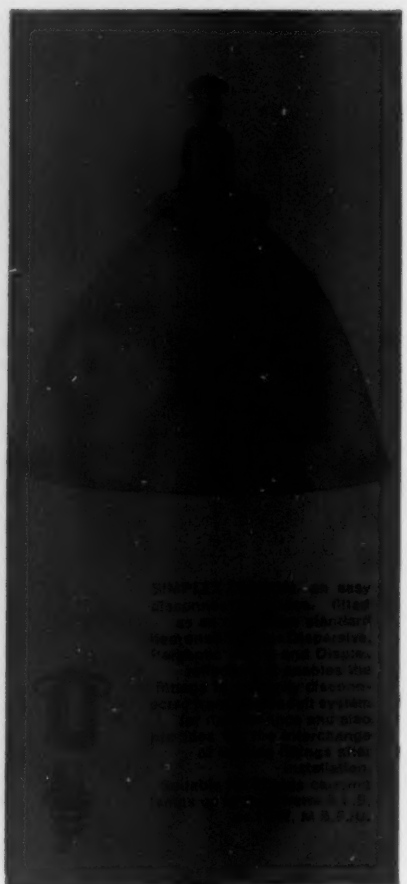

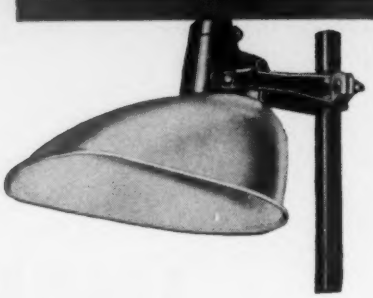

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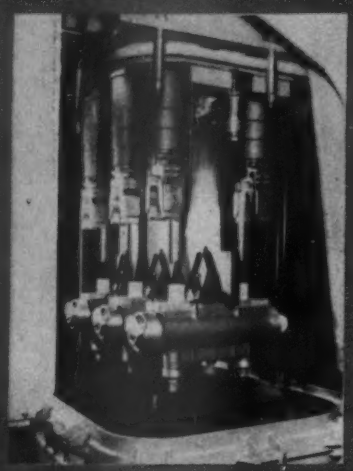

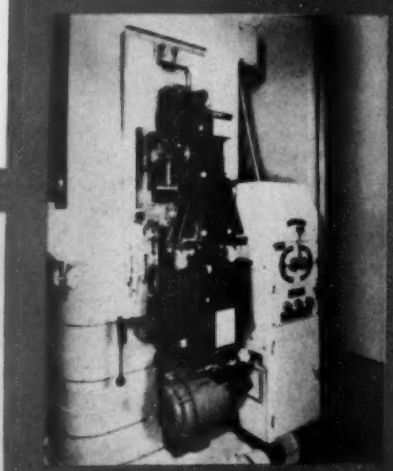

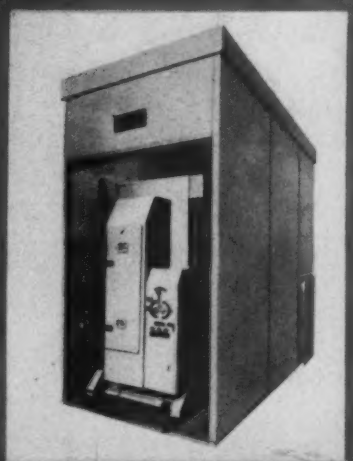

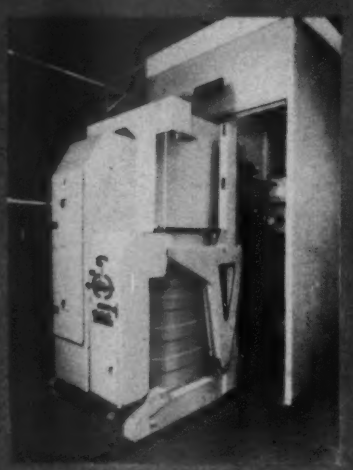

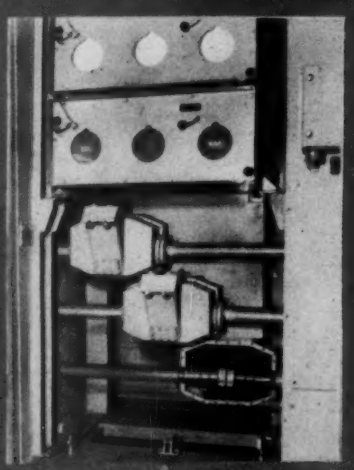

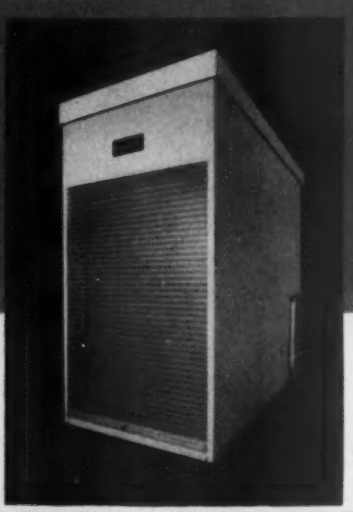

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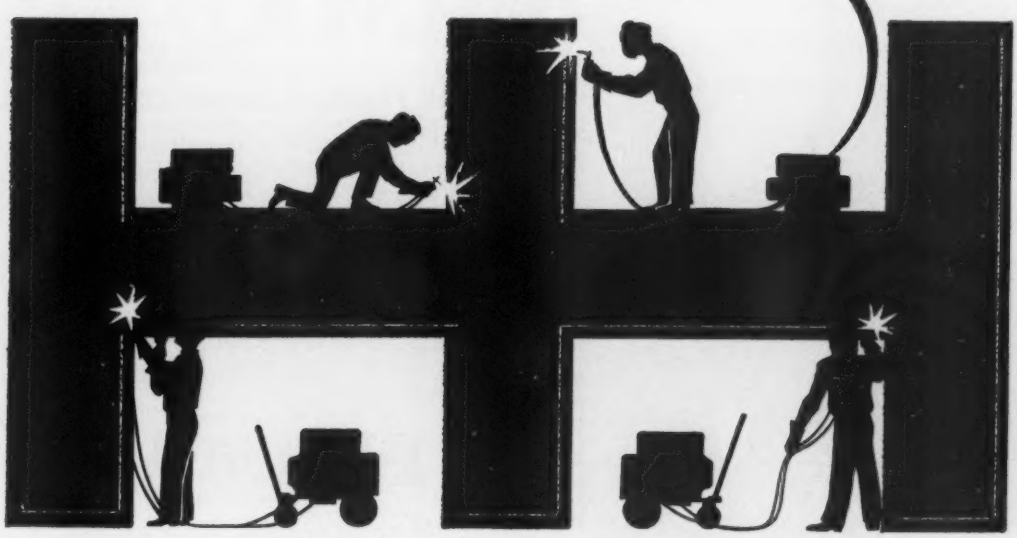

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Dans ce numéro

Interrupteurs complémentaires à transistors 213

Le " redresseur à commande silicone " à quatre éléments est le dispositif semi-conducteur équivalent du redresseur à arc de mercure à commande grille et du thyratron. Comme alternative, on peut se servir de deux transistors à triode standard, dont le premier est un dispositif de commutation et l'autre un dispositif d'amplification. De telles solutions ont été mises à l'essai et ont produit de bons résultats; les dispositifs utilisés ont servi de redresseurs commandés monophasés aussi bien que multiphasés pour l'usage avec des moteurs C.C. et autre équipement semblable.

Technologie des câbles d'alimentation en Amérique, 2ème Partie 223

Les sociétés américaines d'alimentation en énergie font un usage extensif de matérieux synthétiques pour les raccords de câbles. Lorsque les câbles sont installés dans des pipelines, on fait circuler de l'huile à travers des paires de câbles pour donner une moyenne de température. Une technique de remplissage sous pression a été mise au point qui sert à forcer le composé dans les extrémités de scellage des câbles. L'on se sert de conducteurs les plus petits pour les câbles de larges dimensions, mais dans certains cas, les prix d'ensemble sont réduits lorsqu'on fait usage de petits conducteurs ronds plutôt que de petits conducteurs segmentaires.

Remplacement de moteurs électriques 225

Le remplacement des moteurs électriques, à la suite de vieillissement ou de panne, permet d'installer des types modernes à " puissance maximale continue " se conformant à une norme publiée en 1957. Ces types de moteurs comportent un isolement permettant d'obtenir des températures de fonctionnement plus élevées. Lorsqu'on se propose de faire un remplacement de ce genre, il est essentiel d'évaluer l'effet qu'auraient des surcharges provisoires sur la performance et la durée de vie. Dans certains cas, il serait même nécessaire de choisir un moteur ayant une puissance maximale continue supérieure à la puissance du moteur que l'on remplace.

In dieser Nummer

Transistor-Komplementärschalter 213

Die dem gittergesteuerten Quecksilberdampfgleichrichter mit Thyratron entsprechende Halbleitervorrichtung ist der " silicium Gesteuertegleichrichter " mit vier Elementen. Für manche Verwendungszwecke besteht die Alternative der Verwendung von zwei gewöhnlichen Triodentransistoren, von denen einer als Schalttransistor und der andere als Verstärkerelement fungiert. Anordnungen dieser Art wurden bereits geprüft und ergaben zufriedenstellende Leistungen als Einphasen- und geregelte Mehrphasengleichrichter beim Einsatz mit Gleichstrommotoren und ähnlichen Anlagen.

Zur Technologie der Kraftstromkabel in Amerika, Teil 2 223

Amerikanische Kraftversorgungsgesellschaften machen ausgiebigen Gebrauch von Plastikmaterialien bei Kabelverbindungen. Bei rohrverlegten Kabeln wird zum Temperaturausgleich Öl durch Kabelpaare geleitet. Zur Druckeinbringung von Isoliermasse in abgedichtete Kabelendverschlüsse wurde eine Spritzmethode ausgearbeitet. Bei Kabeln grosser Abmessung werden Kompaktleiter verwendet; mit Hinblick auf die Gesamtkosten ist jedoch die Verwendung runder Leiterquerschnitte manchmal vorteilhafter als die segmentförmiger Querschnitte.

Ersatz von Elektromotoren 225

Der wegen Alterung oder Ausfall notwendig werdende Ersatz von Elektromotoren ergibt die Gelegenheit zur Installation moderner Dauerhöchstleistungstypen, die einer im Jahre 1957 veröffentlichten Norm entsprechen. Diese Maschinen besitzen eine Isolierung, die eine höhere Maximalarbeitstemperatur erlaubt. Bei der Erwägung solcher Umstellungen muss der Einfluss vorübergehender Überbelastungen auf Leistung und Lebensdauer im Auge behalten werden. In manchen Fällen wird man sich für ein höheres PS-Dauerleistungsmaximum als das auf den zu ersetzenden Motor zutreffende Maximum entscheiden müssen.

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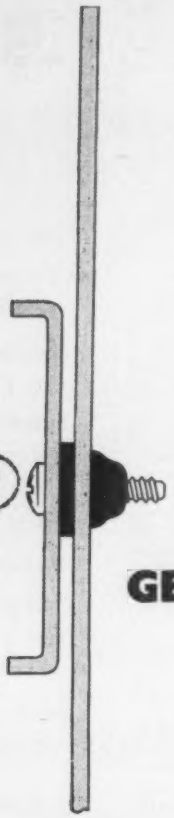

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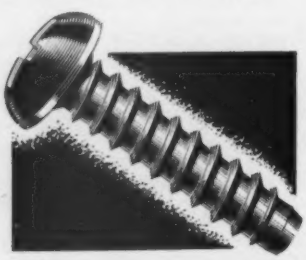

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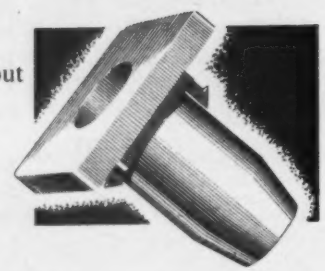

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ELECTRICAL TIMES

ESTABLISHED 1891

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Comment

POWER PUMPING IN SCOTLAND

Announcement of the main contracts for Scotland's 400 MW Cruachan pumped storage project of the Loch Awe scheme comes just as the first set at the CEGB's 300 MW Ffestiniog scheme reaches commissioning stage. Both schemes are closely linked with nuclear power generation, for it is with nuclear stations that the need to even out the demand over the 24 hours presses most strongly. Also, there is no more than about 100 ft difference in the head under which their turbines will operate. None the less, the Cruachan design shows the advance of turbine engineering that has taken place since the Ffestiniog work was started. Ffestiniog uses separate pumps and turbines with common generator/motor units. At Loch Awe the mechanical as well as the electrical plant is used both for pumping and generating, and this with machines a third more powerful than those for Ffestiniog. This should reflect in the capital costs, and a figure of £38/kW has been given for Cruachan, against £42/kW for the Welsh scheme. That such schemes are economically justifiable, with this additional capital cost and only about 70% efficiency, is the strongest of reminders of the importance of off-peak load in electricity costing. Much off-peak load building is marginal in its attraction and the demand is for a wider off-peak/on-peak tariff differential, which the industry should be able to meet. Such load building differentials will become the more important as further nuclear stations are commissioned, since there seems no likelihood of further British pumped storage schemes at an early date, due mainly to the scarcity of suitable sites conveniently placed for transmission.

REVISING A RURAL LANDMARK

The extensive rural electrification programme which the supply industry is pursuing would hardly have been possible without the low-cost line construction offered by BS 1320. Before the war the search for a satisfactory low-cost overhead line was pursued with enthusiasm and with mixed success; such unusual solutions were erected as galvanised steel conductor lines, phase-earthed, three-phase lines and cut timber supports instead of poles. An important step forward was the erection of simple lines with unearthed metalwork and insulated stays, which proved in practice to have a better lightning performance than earthed lines. With this background of experience, in 1946 BS 1320 was evolved and the significance of this step was underlined by the modification of the Electricity Commissioners' Overhead Line Regulations to give official endorsement of the new design. Now the standard is scheduled for revision. Account is to be taken of the extensive operating experience,

the new materials available and improved constructional methods; but no major change is visualised. Thus, the familiar "T" construction that is found not only in all parts of this country but overseas as well will remain the basic design for continuing development. The publishing of BS 1320 was an outstanding landmark in the progress of rural electrification, and the 15 years of service that this design has given the industry and, the amenities it has brought to rural communities in providing low-cost electricity supply, is a tribute to all those who played a part in its drafting and in the experimental work on which it was based.

CONTROL GEAR MAINTENANCE

Latest of the BSI Code of Practice series to appear is the recommendations for maintenance of motor control gear. The continued increase in the amount of control gear in service makes particularly welcome the practical nature of the Code. A recommendation in the introduction suggests that it should be regarded as a document to be made available to operatives. It presents a check list of precautions for them which they are likely to welcome, even if they think (excusably, but mistakenly) that they would themselves have thought of most of the points made; and it adds some fault-locating ideas that are eminently practical and not all immediately obvious. From amongst its many suggestions, one that management should take well to heart is that manufacturers' instructions for equipment, like the Code itself, should be made "freely available to all concerned"—to the man who will do the job, not only to administrative staff. Inclusion of such a remark carries itself an assurance that those preparing the Code are working to a basis of practical experience. Why is it that manufacturers' literature is kept in pristine state in the office, showing no signs of the oiliness that should mark its proper use? That is a minor aspect of maintenance procedure, perhaps, but it is one in which the wrong approach can prove highly time-wasting and frustrating to all concerned.

GEOTHERMAL CAPACITY

New Zealand's geothermal project at Wairakei is well into the second stage of construction now. The first 69 MW installation is a proved success, and the tapping of subterranean steam is advanced enough to ensure the supply for the additional 81 MW of stage two. But there is still plenty of interest for the engineers tackling the development, and problems ahead for them additional to the many they have already tackled. Outstanding is the intention of developing a technique for using the hot water tapped from the bores, as well as the steam. The principle of using it is simple enough. Steam will be flashed from the water by reducing the pressure. Some of the steam will be at a low pressure, of course, but it will still be economically worth while to expand it to vacuum in turbines. When the third stage of the project is reached, with nominal output 250 MW, no less than 35% of the electricity generated should be attributable to the hot water which forms 80% by weight of the discharge from the bores. Another problem that remains to be finally tackled is that of determining the effect on output of steam and water when all the bores in the Wairakei field are operated at full capacity. Will the total output fall significantly from the aggregate of the steam obtainable when each bore is operated alone, with the others shut down? Indications so far are that there will be no serious reduction; there is comparatively little effect even when bores close to one another are operated together—but it has still not been possible to operate the whole field at anything like full output at the same time. There is little doubt, however, that the problems will be overcome, and the notable progress already made carried still further in this fascinating scheme.

P.V.C. FOR CONDUIT

When p.v.c.-insulated cables first began to be used widely they had something of the character of a war-time substitute. The major output was made on plant designed for other purposes, and they were compounded with less knowledge of the requirements of an installation material than is applied today. P.V.C. technique has advanced a long way in the intervening years, but some cable users still give weight to that initial "substitute" tag. When wiring in conduit is concerned, they conservatively call for their familiar vulcanised rubber-insulated and braided construction. Are they making the right choice? The author of an article we publish this week argues that not only is p.v.c.-insulated cable fully acceptable for this application, more than that, it is preferable. Some of the advantages are clear, though marginal. Greater cleanliness in handling comes into this category. The fundamental test, however, must relate to service life, and here the arguments are unequally matched. Lengthy experience in use has established the qualities of v.r.i. cable, although perhaps the experience has not been so long as some may think. The alteration in title from the original v.i.r. to the present v.r.i. marked also a change in the character of the insulation from the former double layer insulation to the present single vulcanised rubber covering. There is little known to the detriment of p.v.c.—perhaps some danger of distortion when it is being over-roughly treated in pulling into conduit—but the qualities related to long-term use have not, in the nature of things, been established. Yet the chemical evidence in this respect is strongly in favour of p.v.c. Old rubber insulation inevitably oxidises to some extent, and the insulation retains its electrical qualities only so long as it remains physically undisturbed. The fundamental composition of p.v.c. insulation is such that it is confidently backed to outlast rubber in a workable, movable condition.

Meteor

This week's quick summary of electrical news faces advertisement page 8

Transistor complementary switches for power control

by E. E. Ward,* Ph.D., A.M.I.E.E.

THE advantages of transistors for controlling electrical circuits are already understood and their falling prices make them increasingly attractive. They offer simple and cheap control when connected as a variable resistance, the small base current regulating the much larger collector current as the dependent variable which it is desired to control. There are, however, valuable advantages in the more elaborate system of control by pulse-length in which the transistor is used as a switch. These advantages and the technique of using the transistor as a switch are now reviewed.

General Principles of Quantitative Control

The principle is well illustrated in the domestic boiling plate. Assuming a heating element of constant resistance, R, fed from a supply voltage, E, and, therefore, having a maximum heat output of W_o watts where $W_o=E^2/R$, we might imagine it to be controlled by a variable series resistor, r. The heat liberated in the control resistor, r, can be as much as $W_o/4$ and this, when set to the value $r=R$ —which gives an output $W_o/4$ from the boiling plate as well—results in an efficiency of only 50%. The size, weight and cost of the control resistor would correspond to its maximum heat dissipation, $W_o/4$.

The control element used in practice is a switch which oscillates between open and closed positions, the mean heat output of the boiling plate depending on the proportion of the cycle spent in the closed position. Heat is dissipated in the switch only in the closed position, the resistance of the closed contacts being small and the heating smaller, by orders of magnitude, than that of a hypothetical series-connected control resistor, so presenting a compact and cheap device. However, this control has to act as a circuit-breaker once every working cycle. On an alternating supply, and at present domestic loadings, the resulting arc can be extinguished without adding much to the cost of the switch so long as the load is purely resistive. The switch must, of course, also withstand the full voltage of supply during those portions of each cycle when it is open. This, again, can be ensured without much expense.

A resistive load such as a heating element is, however, the simplest load for this kind of control. Any energy stored in the load, either capacitive or inductive, imposes additional duties on the switch contacts or insulation and are penalties to be offset against the low energy loss in the switch. Supposing, for example, that the load included parallel capacitance. The initial current at the instant of closing the contacts would then be increased and this might force the designer to increase the size of the contacts. If, alternatively, the load were to include series inductance, the voltage across the switch contacts would rise sharply at the moment of break and could considerably exceed the supply voltage. The designer would then have to provide more elaborate means for extinguishing the arc and better insulation to withstand the higher voltage stresses. The respective currents and voltages are shown graphically in Fig. 1. It is clear that, where the load contains considerable stored energy, these penalties could weigh seriously against control by oscillating switch.

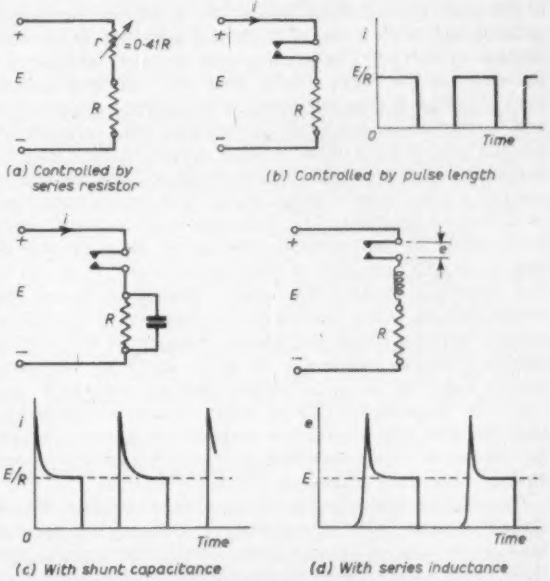

Fig. 1. Control circuits embodying resistor or pulse length showing effects of capacitance and inductance in load on contacts and insulation

The problem of extinguishing the arc on breaking a reactive circuit becomes simpler when an a.c. supply is used, since the voltage passes through zero twice each cycle. It is, in any event, an advantage to use such a supply, even where d.c. is needed for the load, since public supplies today are mostly a.c. Finally, it may be possible to make use of one of the several kinds of switch which time their own moment of opening to occur at, or near to, an instant of minimum current or voltage. These facts explain the very great technical advantage of the combination of a.c. supply with controlled triode transistor devices which deliver a d.c. controllable in amplitude or an alternating current at changed frequency.

For this service the transistor switch element must be capable of the following three distinct states of operation; the A state, a non-conducting direction under reverse voltage; no significant current may flow at any reverse voltage under a rated limit: the B state, a conducting direction of forward voltage but before any closing or trigger signal has been applied; no significant current may flow at any forward voltage under a rated limit, and the C state, a forward conducting condition after the switch has been closed by a trigger signal. High current capacity and small voltage drop are required here. This state should revert rapidly to the A or B states at a certain minimum voltage or current which should be a fraction of working values.

* Department of Electrical Engineering, Southampton University.

It is usually necessary for the rated limit of voltage in the A and B states to be about twice that of the maximum output voltage. Polyphase circuits are preferable on alternating supplies. The maximum output power of a system therefore rises with the number of phases, the voltage rating and the current allowable in the C state. A bibliography of the subject up to 1951 is given by Bingley.[1]

The Switch Element

Historically, the technique was first developed for the grid-controlled mercury-arc rectifier and the thyratron and has since been applied to other devices. The thyratron is the only one of these which has a heated thermionic cathode and needs a period of careful warming-up to avoid damage at starting. The mercury-pool rectifier, ignitron and the excitron are more robust than the thyratron but all mercury-filled devices are sensitive to ambient temperature and, in particular, are liable to backfires when overheated. Simpler and cheaper than rotating machines, they may be designed to carry current of thousands of amperes and to sustain, without conduction, forward and reverse potentials of scores of kilovolts. The potential drop in the C state corresponds to the ionisation energy of mercury vapour and is roughly constant in the region of 14 V to 18 V. The difference between the switch potential drop and the output voltage, when expressed as a fraction of the output voltage, gives a crude but useful measure of the overall efficiency. If the switch p.d. be taken as 15 V, the ratios are 0·9 and 0·99 when the output voltages are 150 V and 1,500 V, respectively. These high values of efficiency, together with the advantages enumerated above, explain the number of recent installations in which mercury-vapour devices have been chosen as control elements.

However, semiconductor devices have equally strong claims in most fields of application. On starting up, full load can be applied at once without delay for warming-up, there is no vacuum envelope or contained fluids and they are outstandingly robust. It is true that some properties are particularly sensitive to temperature but, in practice, this is no more serious than in mercury-vapour devices. Their most significant property, however, is the very low voltage drop in the C state rarely exceeding 1·5 V, which is, roughly one-tenth of the arc drop in a mercury-vapour device. The efficiency of a complete system using semiconductors at 300 V, will, therefore, be close to that of a mercury-vapour device at 3,000 V.

There are two semiconductor switches available which are suitable for such duties. One comprises three *p-n* junctions separating four distinct impurity layers in a crystal of silicon[2] and is now commercially available; the other switch is a circuit arranged to control a standard triode transistor. It is the latter which we shall here consider. The currents in a transistor flow in such directions that no passive circuit element can be connected to produce two stable states equivalent to an open and closed switch. These states are, therefore, produced by an auxiliary transistor which is used as an amplifier and is of complementary polarity to the switching transistor; that is, if the switching transistor is of the *p-n-p* type, the auxiliary must be *n-p-n*. The complete circuit will then be known as a complementary switch and is shown in Fig. 2.

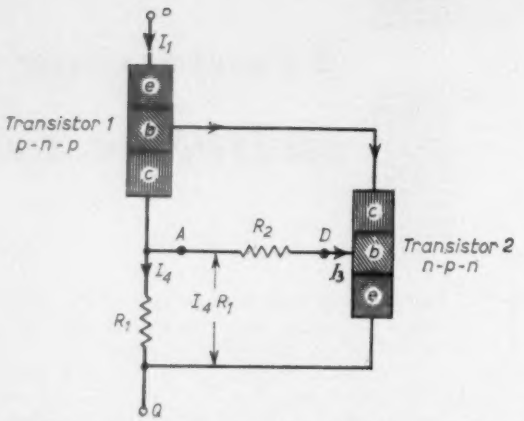

Fig. 2. Two triode transistors coupled to form a complementary switch

The Complementary Switch

In the circuit of Fig. 2, P and Q are the terminals of the switch, the main circuit current flowing from P to Q when P is positive to Q. To explain the working of the circuit, transistor 1, which acts as the switch, will be taken as of *p-n-p* polarity and transistor 2 as *n-p-n*. (The analysis may be applied to transistors of the opposite polarity by reversing the directions of all the currents and voltages.) Transistor 1 is used in the B and C states in the direction for which it was designed. In the A state it must hold off the applied inverse voltage and, since triode transistors can work—though not efficiently—with supplies reversed, it becomes one of the functions of transistor 2 to prevent conduction in the A state. The three states are established as follows:

A state: Terminal Q positive with supplies reversed on transistor 1, its emitter acting as a collector and its collector as an emitter. To prevent any flow of current, base and collector must be at the same potential. The reverse voltage between P and Q is sustained by the emitter junction of transistor 1 while all other electrodes of both transistors are at the potential of terminal Q (Fig. 3). The inverse voltage which the switch will withstand in the A state is the voltage which may safely be applied to the emitter junction of transistor 1.

B state: Terminal P positive. Both transistors are polarised in their normal intended directions. To prevent conduction, the base of transistor 1 must be connected to P and the base of transistor 2 to Q. Thus, both collector junctions are supplied in their normal working polarity (i.e., with reverse bias) and each must withstand the applied voltage of the B state. (Fig. 3.)

C state: Terminal P positive. This is produced from the B state by an unstable transition prompted by a trigger pulse as explained below. Each of the transistors is conducting as a closed switch, its main current path being between emitter and collector. To keep down the potential drops between these electrodes, both transistors must have heavy base currents and their collector potentials must lie

State	Terminal		Transistor 1			Transistor 2		
			Emitter	Base	Collector	Emitter	Base	Collector
A	Q	+						
	P	−						
B	P	+						
	Q	−						
C	P	+		430	330	1060	$I_4 R_1$ = 630	300
	Q	−						

Fig. 3. Table showing relative electrode potentials of transistor elements in the three states of a complementary switch

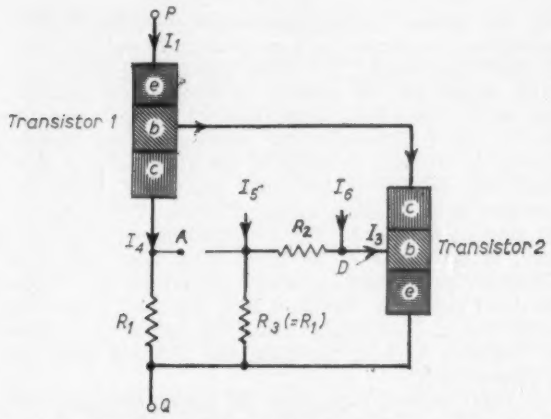

Fig. 4. Modification of Fig. 2 used in study of stability of the B state

between the potentials of their respective emitter and base. That this is possible for both transistors may be seen from Fig. 3. The transistors are connected in opposite directions in the circuit but, since they are of opposite polarities, the voltage drop I_4R_1 offers a normal supply to both. This voltage gives transistor 2 a heavy base current and a positive base potential so that it acts as a closed switch. As a result, transistor 2 causes the potential of the base of transistor 1 to approach that of terminal Q while the potential of the corresponding collector is made positive by the potential I_4R_1. Consequently, transistor 1 acts as a closed switch with a p.d. of a fraction of a volt.

The switch will remain in the C state given sufficiently large value of α_1' and α_2' (common emitter current amplication factors) of the resistor R_1 and of the load current I_1 passed by it. Fig. 3 shows the potentials in mV for a load current of just over 2 A. The conducting path from emitter to collector of transistor 1 has a p.d. of 430 mV but that this figure is only achieved by making its base negative to the collector by 330 mV, a total of 760 mV. To do this the p.d. across transistor 2 is 300 mV, a total of 1·06 V.

In the A state the emitter of transistor 1 cannot pass current since its potential is negative and it is almost impossible to cause triggering of the circuit by a pulse of current of either polarity wherever it might be applied to the circuit. This state is, therefore, highly stable.

The B State

To study the stability of the B state it is useful to take the loop circuit in Fig. 2 and to break it the point A to give a control chain (Fig. 4) where a resistance R_3, equal in value to R_1, has been added to close the path at A. Assume input currents I_5 and I_6 applied as shown and assume that the potential between P and Q, determined by the circuit conditions, is constant. It can be shown[3] that the collector current of transistor 1 (I_4) is a linear function of the base current of transistor 2 (I_3) providing only that the common base current amplification factors are constant which, in practice, is roughly true. The circuit embodies another functional relationship. The dependence of the base current, I_3, on the potential drop across R_2, due to the base current, I_5, is fairly close to being exponential. If these two graphs are superimposed, as in Fig. 5, for any given pair of transistors, they cross at three points, meet tangentially or do not meet at all dependent mainly on the value of the resistance in the collector circuit, R_1. (The upper asymptote of I_4 is independent of the base current, I_3, being determined by the external circuit.)

The lower of the points of intersection, P_1, is stable while P_3 is instable. P_1 represents the B state and P_2, which is also stable, the C state. If R_1 is increased (being equal to R_3), the solid curve will increase its slope to the right and points P_1 and P_3 will approach each other until they meet where the dotted curve, AEF, becomes tangential to the solid curve OCD. The value of R_1 on this limiting curve is the largest which will allow the B state to remain stable. It will have to be reduced if the saturation currents of the transistors or their current amplification factors should increase. Such curves may be plotted for any given pair of complementary transistors and may be used to predict the current needed to trigger the circuit from the B state to the C state.

The C State

The C state is, as has been said, represented by the point P_2 and its position is determined by the current in the external circuit. With a fall in current, P_2 approaches P_3 and, at a critical minimum value, will coincide with it. The C state is then no longer stable. This value is the minimum which will hold the switch closed and all currents in excess hold the C state stable.

In the design of a controlled transistor rectifier, it is necessary to be able to predict all of the currents and potentials of both transistors when conducting in the C state, to determine the voltage drop when conducting and to establish the upper limit to the load current of the switch. Methods of doing this have been explained elsewhere.[3]

Increase of Power Output

The current output of each complementary switch may be increased by connecting transistors in parallel. The voltage output might, with suitable precautions, be multiplied by connecting transistors in series but it is, in practice, simpler to connect several complete complementary switches in series, each being fed with its own trigger pulse from a separate winding on a pulse transformer. A potential divider across the chain of switches will control distribution of potentials in the A state.

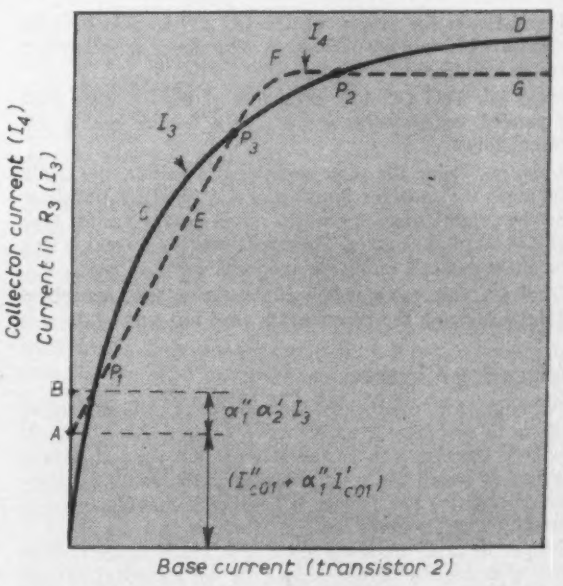

Fig. 5. Graphical study of the stability conditions apertaining to the B state of a complementary switch

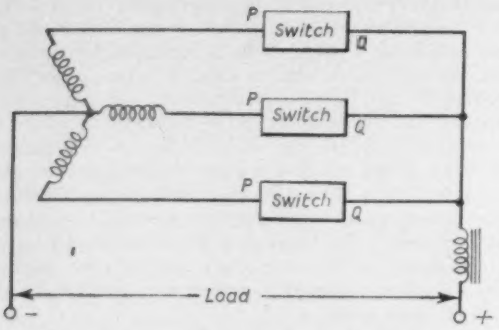

Fig. 6. Basic circuit of complementary switches applied to a d.c. load fed from a 3-phase a.c. system

Practical Tests

Complementary switches have been tested and have given entirely satisfactory performance in circuits such as that shown in Fig. 6. A 2 ohm metal resistor was shunted across each *p-n* junction to form R_1 (Fig. 2) and R_2 was replaced by the output winding of the pulse transformer. The latter gave a triangular pulse of peak value 0·5 V and base duration 1·5 millisec, its timing being controlled by a phase-shifting transformer. The output voltage was limited by the *n-p-n* transistors to about 11 V; the average current was about 4 A. Control of the output voltage down to zero was obtained by delaying the phasing of the trigger pulse.

The current/voltage graphs for several switch arrangements are shown in Fig. 7.

Graph (a). A switching transistor type V60/30P and an auxiliary control transistor, type OC 139, of low α'. The *p-n* diode was the collector junction of a V30/10 LP transistor. Saturation current of junction $R_1(I_{01}) = 170$ μA; Resistance of junction $(R_4)=0{\cdot}03$ ohm.

Graph (b). For the same transistors. The *p-n* diode was the emitter junction of the same transistor for which $I_{01}=115$ μA and $R_4=0{\cdot}08$ ohm. The graph shows that the overall voltage drop and the upper limit of current have both risen.

Graph (c). As for graph *(b)*, the OC 139 transistor being replaced by a sample of high α'. The upper limit current has again risen.

Graph (d). Two OC 139 transistors of high α' were used in parallel, otherwise as graph *(c)*; a further rise in the current limit.

Graph (e). Using the same switching transistor, the diode was made the collector junction of a V30/10 LP transistor and the control transistor was a power-output unit of type GT.424 taken at random. The upper limit of current is well above the maker's rating for the switching transistor.

Graph (f). This was a switch of reverse polarity assembled by interchanging the components used for graph *(e)*.

Triggering Circuits

Circuits for producing the necessary trigger pulses belong to two large groups: active circuits using bi-stable dynamic devices, such as the Schmidt circuit, and passive devices of which the most common is the saturated iron-cored inductor. The former is cheaper if manufactured in quantity since it needs no coil windings but the latter is cheaper in small numbers since it is much simpler. Both may give control of the output by an electrical current or voltage so that no mechanical motion is needed.

For power conversion, a simple robust system results from the splitting of the conventional pulse transformer into its two components; an iron-cored choke and a heavily saturated transformer. The choke passes a roughly sinusoidal current and the moment of firing of the switches may be controlled by a direct current which polarises the core of the transformer. The principle of this system restricts the advance or delay of the firing pulse to well under 90° so that, if the direct polarising current be reversible in direction, a range of between 75° delay to 75° advance is possible. The controlled output is proportional to the cosine of the firing delay angle and it is convenient to connect the choke circuits so that, when the direct polarising current is zero, the delay angle will be 90° and the output also zero. This adjustment is also the boundary between rectifying and inverting functions of these circuits.

In high efficiency equipment the circuit resistance will be low and considerable output current will flow unless the timing of the firing pulse gives a delay angle α of exactly 90° when the direct polarising current is zero. An inexpensive iron-cored inductor will pass a current lagging about 84° behind the supply voltage at 50 c/s and this departure from 90° may not be acceptable. The circuit of Fig. 8 allows the phase of the pulse-transformer excitation to be adjusted by the resistors R_1, R_2 and R_3 so that the firing delay angle passes through and may exceed 90° and the correct adjustment may be found. The three resistors are controlled by a common shaft. The currents are marked to correspond in the circuit and vector diagrams.

For operation on a 440 V, three-phase supply it has been found convenient to use iron-cored chokes which pass 250 mA on a 50 c/s, 440 V supply when connected between phases. The pulse-transformers may have a core of 28 laminations of Permalloy C in size 227 and several windings, each of 200 turns. The windings, which trigger the complementary switches, may well have considerably less turns and the connections may, in general, follow Fig. 8. If a polarising direct current be passed through one of the windings on each transformer, the well-known behaviour will be obtained, namely the cosine of the angle of firing delay α will be proportional to the polarising direct current. Since the output current is proportional to cos α, the output will be a linear function of the polarising current.

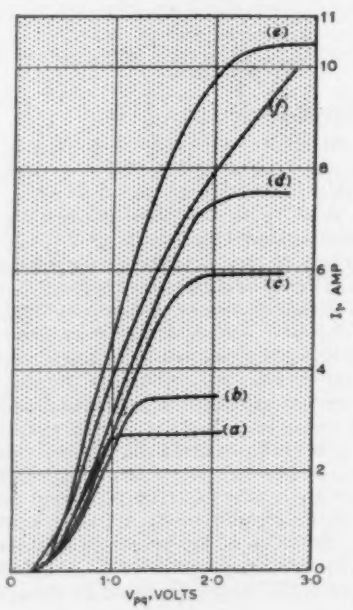

Fig. 7. Voltage drop graphs of various switch arrangements in the C state. Details of arrangements and types of transistor are given in the text

The Control of D.C. Motors

Using the technique already explained, the complementary switch may be applied in any of the ways already devised for thyratrons and ignitrons. The paper by Bingley[1] gives details. Only one such application can be treated here and the control of a d.c. motor is chosen because it is a common and important practical example and also because, containing in the load circuit a generated e.m.f., it is the most general case of the theory.

Consider the circuit arrangement in Fig. 9. If the inductor, L, be large enough, the current pulse through each switch can be made to last for $2\pi/p$ radians, p being the number of switches and the armature current can be continuous though fluctuating. Taking R_ϕ as the total resistance in the d.c. path (including R_s, the transformer equivalent resistance, plus that of the inductor and the armature), I_m as the mean direct current, V_g as the generated back e.m.f. and V_d as the converter output voltage, then

$$V_d=(V_g+V_o)+I_mR_\phi$$

which may be normalised to

$$\frac{V_d}{V_{do}}=\frac{V_g+V_o}{V_{do}}+\frac{I_mR_\phi}{V_{do}}$$

If we define a factor a proportional to speed as

$$a=\frac{V_g+V_o}{V_{do}}$$

and a factor k_{TR} proportional to torque as

$$k_{TR}=\frac{I_mR_\phi}{V_{do}}$$

then since, by familiar theory of converters, $V_d/V_{do}=\cos\alpha$ we have

$$a+k_{TR}=\cos\alpha$$

This equation, which is represented graphically in Fig. 10, expresses in general form what is already familiar, namely, that the drop I_mR_ϕ reduces the speed. It also confirms that,

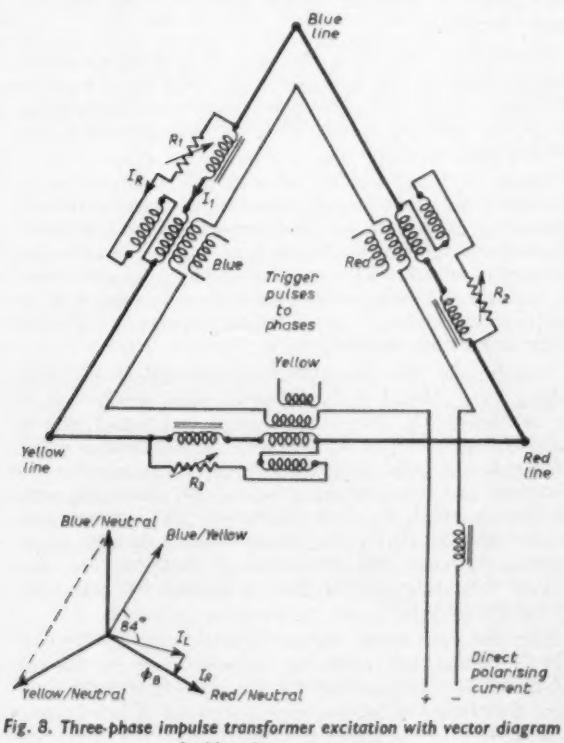

Fig. 8. Three-phase impulse transformer excitation with vector diagram for blue phase at zero output

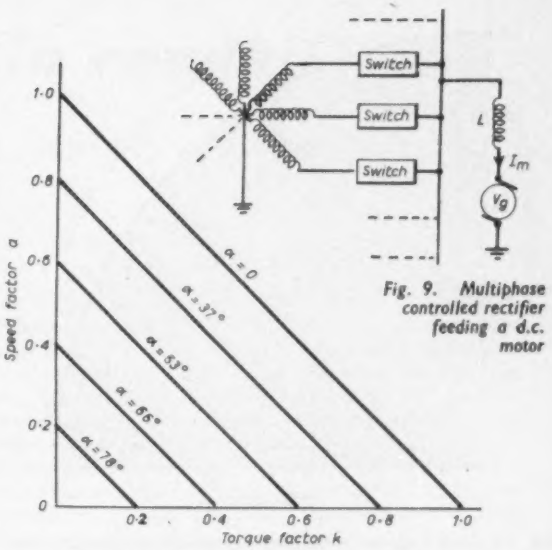

Fig. 9. Multiphase controlled rectifier feeding a d.c. motor

Fig. 10. Relationship between speed and torque factors for different angles of firing delay on a d.c. control system

subject to the assumptions made (constant field flux, negligible armature reaction, large inductance of L), a very small value of R_ϕ will render speed independent of torque.

Of these assumptions, it is only the magnitude of the inductor, L, which reflects on the design of the transistor circuits. The designer's task in practice is to make L as inexpensive as possible. He has to meet conflicting needs at the ends of the torque range which are, (a), low torque and low current: L should be large enough to prolong conduction through each switch for $2\pi/p$ radians, and (b), high torque and heavy current. A much smaller value of L will be enough but the resistance drop in it will contribute to the total drop I_mR_ϕ and increase the fall of speed with torque.

Between these two needs the designer must decide how much iron and copper are wanted. Requirement (b) is, perhaps, the easier to estimate of the two, leading to an upper limit for the winding resistance of L. The inductance necessary at minimum load may be estimated by Demontvignier's method,[4] assuming that R_ϕ is negligible by comparison with ωL, taking a new torque ratio $k_{TL}=I_m\omega L/V_{do}$ and a quantity, J, determined by the number of switches, namely $J=(1-\pi/p\cot\pi/p)$

Supposing now that we wish to ensure continuous conduction through the switches down to a fraction a of no load full speed, the firing delay angle will be $\alpha=\cos^{-1}a$ and the minimum value of inductance at load current I_m will be given by $k_{TL}=J\sin\alpha$

The calculation may conveniently be made by using the circle diagram of Fig. 11. Taking a numerical illustration of a three-phase circuit using three switches, suppose that we wish to ensure continuous conduction down to 10% of no load speed and that the torque will demand a direct armature current, I_m, at this speed. The speed factor $a=0{\cdot}1$ and the horizontal AB is drawn with ordinate 0·1 cutting the circumference in B, giving a delay angle of 84°. Since p=3, J=0·397, if OC be drawn with radius J = 0·397 the horizontal projection, OD, is of length, J sin α, in fact 0·395. This is the minimum value of k_{TL} and from it, knowing the supply pulsatance ω, the minimum inductance L is given. The polarising d.c. of the pulse transformers is also given as a fraction of the peak excitation current since this fraction is equal to the speed ratio a.

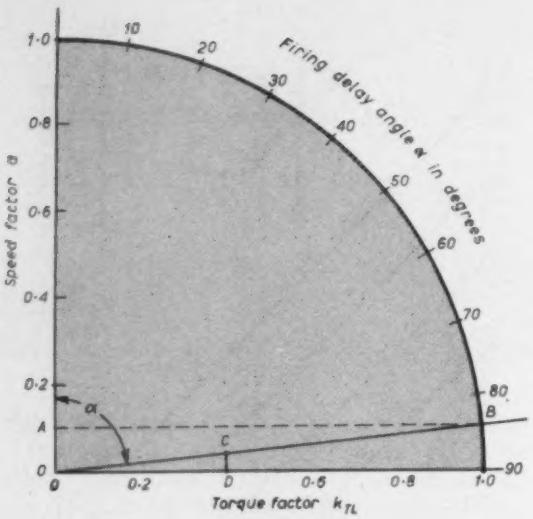

Fig. 11. Circle diagram for the determination of minimum inductance, L, with given speed and torque factors

In fact, if the minimum speed factor is 0·3 or less, the calculation may be simplified by taking sin α as 1 so that the minimum value of k_{TL} is J. In this case the minimum inductance L_{mm} is equal to $JV_{do}/\omega I_m$.

The foregoing has shown that there are simple ways of designing complementary switches to give them the properties of thyratrons. The voltage and current output which may be obtained from a given number of them will depend on the progress made by transistor manufacturers. On economic grounds their attractiveness will hinge on the selling price of the silicon controlled rectifier which is the only device of similar performance.

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Supply Progress in New Zealand

ELECTRICITY generated in New Zealand rose by 7½% in the year ended 31 March compared with the previous year. In North Island, generation increased by 7·7% to 4,760 million units, while in the South Island the rise was slightly less, by 6·9% to 2,075 million units. No trouble was experienced in meeting this demand, although when the maximum demand occurred on 26 July last year the supply frequency fell to 48·4 c/s. However, this was due largely to firing difficulties at the Meremere power station. Trouble was also experienced at Wairakei station, but these were not sufficient to necessitate supply restrictions.

The Minister of Electricity refers, in the report introduction, to the growing acceptance of the scheme for development of power resources of the whole country as a unified project. Important in this connection is the 500 kV d.c. link between North Island and South Island systems. During the year a study was made on sea currents along the proposed cable route and a tentative site was selected for installing the sea electrodes for the system.

During the year two machines at the hydro-electric station at Ohakuri were commissioned, increasing the output to 56 MW. At the Wairakei thermal station, output was also increased by a further 11·175 MW, and a 17 MW unit was also brought into service at Waipapa. In the South Island, the fifth 40 MW set at Roxburgh, was commissioned. Some boiler troubles were experienced at Meremere station during the year, while at Wairakei severe vibration in an intermediate-pressure machine was traced to blade damage in the second stage. Reblading of the rotor was carried out and similar treatment was necessary for another set.

The transmission network was extended by a 110 kV line from Kikiwa to Blenheim and several additions were also made to the 220 kV network on both islands. There are now over 1,100 miles of 220 kV line and nearly 3,700 miles of line operating at 110 kV. Some trouble was experienced with faulty transmission line joints and also with 220 kV minimum oil-type circuit-breakers in substations and at a power station. However, reliability of supply increased.

There were 10% fewer incidents causing supply interruption than in the previous year, although the total incidents rose by 20%. Successful operation of high-speed automatic reclosers on the 220 kV system prevented five interruptions of supply.

Supply to heavy industry was studied with a view to estimating the effect on the transmission system of heavy fluctuating loads such as those imposed by arc furnaces. A study of high-speed, selective pole, automatic reclosing protection on a 220 kV line showed that great difficulties in accurate reclosing resulted from the very high footing resistance of towers. A supplementary system using earth fault relays was studied.

Prohibitions on unqualified people doing electrical wiring were relaxed during 1960 to allow minor repairs to be carried out. Every householder was issued with a pamphlet on the repair of fuses and courses are also being arranged with educational institutions. The number of electrical accidents rose by three to 134, compared with the previous year, while the number of fatal accidents was seven higher at 21. Electric blankets and pads were again responsible for a high proportion of electrical fires, 115 out of 170, although the total was over 100 less than in the previous year.

For the year under review, revenue rose by 7% to £18·33 million and operating expenses rose by 9% to £5·48 million. The surplus for the year of £952,000 has been transferred to reserve, raising the total of this fund to £3,021,000.

P.V.C. cables in conduit

THE CASE FOR PREFERRING THEM TO V.R.I. CABLES

by J. Flood,* Associate I.E.E.

IN certain quarters there seems to be some doubt about the acceptance of p.v.c.-insulated cables for use in conduit installations, in place of the traditional vulcanised rubber-insulated, cotton braided and wax compounded cable. Maybe this is because, in its early usage some years ago, difficulties were experienced due to the flow of insulation under pressure and rise in temperature. There are today several advantages in using modern p.v.c.-insulated cables, not least the cleanliness compared with v.r.i. and braided cables. With the latter, in wiring operations carried out after decorations have been completed, one cannot always avoid around outlet boxes, the walls and ceilings being marked by the coloured dyes used in some v.r. cable braids. In fact, it is now recognised that p.v.c.-insulated cable produced by a manufacturer of repute using high quality materials provides an installation which, under similar conditions of use, is likely to outlast vulcanised rubber-insulated cable. The reasons for this are concerned with the chemistry of cable materials.

Rubber Insulation

Natural rubber, compounded with various materials to improve its mechanical properties and containing sulphur and accelerators for vulcanisation and antioxidants to increase its useful life, produces a cable insulation which has an initially high electrical resistance and high physical properties. Due to the known tendency of vulcanised rubber compounds to oxidise in the presence of air, the vulcanised rubber will, over the course of years, gradually deteriorate and, slow though this process is, with modern well-designed compounds, it is inevitable that in the course of time the deterioration will be such that the cable can no longer be regarded as reliable.

The life of a rubber-insulated cable installation is subject to a number of factors and it is not possible to give any reliable estimate of such life. It is known that there are installations of rubber-insulated cables which are performing, apparently satisfactorily, 40 or 50 years after installation, but examination of such cable invariably reveals that the insulation has greatly deteriorated and is in such a state that any disturbance of the cable would result in failure of the installation.

P.V.C. Chemistry

P.V.C., as used for cable manufacture, is a compound produced from an extremely stable material, polyvinyl chloride polymer. The polymer is mixed with plasticisers to impart flexibility, with stabilisers and lubricants for the purpose of facilitating processing in the manufacturers' works, and with pigments for colour identification of the cable. The pigments, particularly black pigments, also serve the purpose of giving weather protection to p.v.c. compound.

The properties of p.v.c. compounds depend to some extent on the compounding of the material. For example, a compound containing a high proportion of plasticiser will be flexible at normal and sub-normal temperatures, but at elevated temperatures will become unduly soft. Conversely, a low percentage of plasticisers will produce a compound which will withstand elevated temperatures without undue softening, but the compound will become rigid at low temperatures. Obviously, the design of a p.v.c. cable involves a selection of the most suitable type of compound for the conditions under which the cable will be required to work.

Conduit Wiring

A conduit wiring cable calls for a p.v.c. compound which, provided it gives an adequately flexible cable for pulling into conduit, should have the maximum possible life. This is attained by using the highest grade of p.v.c. combined with high quality plasticisers, which will ensure adequate insulation resistance and the greatest degree of stability. Whilst the insulation resistance of p.v.c. is not generally so high as that of vulcanised rubber, p.v.c. cables have more than adequate insulation resistance for wiring installations and the insulation resistance is, under normal conditions, maintained.

It can be confidently stated that present-day p.v.c. cables produced by reputable manufacturers are most satisfactory. P.V.C. compounds are designed to ensure electrical and mechanical properties of a high order and the cables are produced on modern plant, working to the close tolerances demanded by the British Standard for p.v.c. wiring cables.

It is not possible to draw on experience of installations of current high quality p.v.c. wiring cables to say what the life of such cables would be, but it is known from the properties of the materials employed in their construction that a p.v.c. wiring cable should outlast a vulcanised rubber cable under the same conditions of installation.

* Mr Flood is with Troughton and Young Ltd.

C.E.R.N. AT CROSSROADS

WHETHER CERN remains an organisation with a fixed budget and staff complement, or whether it stays in the forefront of high energy nuclear physics, are questions raised by the Director General in the annual report. This sixth report of the European Organisation for Nuclear Research outlines the work done in 1960. The synchro-cyclotron, the first of two accelerating machines, came into use during the year, but already plans are in hand to modify it, probably in 1962. The proton-synchroton was used throughout the year, a steady improvement in beam intensity being achieved. Plans for modifying this machine are under consideration, but they would require considerably more space than is at present available and expansion of the present site is proposed in the report.

Constructional Problems of New Zealand's 250 MW Project

GOOD progress is being made with the second stage of New Zealand's Wairakei geothermal generation scheme, which will add 81 MW to the stage 1 scheme that produced 384 million kWh in the year ended 31 March last. Already, sufficient steam has been tapped by drilling to ensure the power to drive the 150 MW of generating capacity involved. Such good progress has been achieved by overcoming many novel difficulties, as a recent statement from the New Zealand Government shows.

The main difficulty is that of collecting the steam, which is produced due to hot fluids ascending fissures in the thick base rock, which is of unknown depth. It has not been possible to penetrate the base rock yet, and the best results, in terms of steam production, have been obtained by tapping the hot fluids at fault planes near the top of the base rock.

Fig. 1. One of the expansion loops on the main pipeline run. Five 20 in. dia pipes feed the "A" power station

Drilling for Steam

So far, 85 bores have been drilled at Wairakei and 60 of them have been suitable for steam production. Average depth has been 2,000 ft, but as shallow as 560 ft has proved successful in some cases; in others, it has been necessary to go to 4,000 ft. Drilling techniques follow closely those used in oilfields, and the bulk of the drilling work is carried out by two American drilling rigs having 95 ft telescopic hinged masts of 80-ton capacity and a nominal range of 1,500 ft to 3,000 ft. These are readily transportable from one site to another.

Drilling involves not only production of the bore but also cementing a seamless steel casing to the walls of the hole. As the hole deepens the diameter of the casing is reduced. Finally, 6 in. lining is used for the bottom section of the bore.

During drilling, "mud" is pumped down the interior of the drill pipe, returning to the surface hot and laden with rock cuttings. Included amongst the incidental equipment of the drilling operation is a cooling tower through which the mud is circulated, with an extraction rate of between 4 million and 6 million B.Th.U./hr. The mud emerges from the bore at between 55°C and 65°C in normal conditions, although sometimes boiling point is reached.

Steam Discharge

When the bore is finished, the task of harnessing the steam has to be faced. At first, the bore is allowed to discharge vertically until no debris is being ejected. At this stage a horizontal by-pass is fitted, terminating in a silencer, and the bore is allowed to discharge horizontally. When the bore is shut off, pressures as high as 500 lb/sq in. may be generated, although between 50 lb/sq in. and 90 lb/sq in. is more common.

Use of silencers, already mentioned, is important for the well-being of those working on the geothermal project. Levels as high as 140 decibels have been recorded—above the threshold of feeling and above the noise level described in one reference book as "heavy gunfire." Various types

of silencer have been developed, the most effective being a twin-tower cyclone consisting mainly of two 12 ft reinforced concrete pipes each 6 ft in diameter. Water and gas enter at the bottom of the pipes and are divided by a steel splitter between the pipes. The water separated by the resultant spiral flow leaves over a weir at the base of the silencer, while the steam escapes from the top with a sound which, heard from a distance, has been described as "like the roar of heavy surf."

The steam emerging from a bore contains about 80% water, with a comparatively small content of chemicals—chiefly sodium chloride, silica, potassium salts and metaboric acid. Gases present are largely carbon dioxide and some hydrogen sulphide, with several minor constituents. In the initial stages the steam only has been used, but it is planned to use the hot water through flash generation in part of the stage 2 scheme, and more in stage 3. In the ultimate development as planned at present, about 35% of electricity generation will come through use of steam flashed from hot water.

Collection and transport of the hot water introduces another difficult problem for the engineers at Wairakei. However, a pilot scheme has been established, which it is hoped will be working by the end of the year. This will involve pumping the hot water into a common pipeline feeding the power station, care being taken that the water remains under positive pressure to prevent flashing in the pipes. The operation of the twin-tower silencers at each well head at present causes about 18% of the hot water discharged from bores to flash into steam.

Steam Transport

Five 20 in. diameter seamless m.s. pipes take the steam from the collecting points to the power station. For operating purposes, bores are classified according to whether they produce steam at about 210 lb/sq in., or at about 80 lb/sq in.—h.p. and i.p.—and separate lines are provided for each pressure. The main lines are 1½ miles long and each is fed by several miles of smaller diameter branch lines. Thermal expansion is a major problem in operation and the mains are mounted on concrete pedestal blocks fitted with rollers to allow for movement. In addition, the pipes are pre-tensioned to reduce expansion. Despite this precaution, it is estimated that there will be 22 ft of expansion to take up between the most distant bore and the power station.

Fig. 3. Trailer-mounted drilling rigs are used on the production bores, one of which is shown here

On the main lines, expansion is absorbed by vertical expansion loops fitted with articulated expansion compensators of stainless steel. These are situated midway between anchor points provided at 1,000 ft intervals.

Jet condensers are used in the power station, for which the first building is now complete, 200 ft long by 200 ft wide and 75 ft high. In view of the nature of the location, both the structure and the fittings are designed to withstand earthquake shocks. Steam is admitted direct to the turbines without the interposition of heat exchangers. This is possible because the gas content of the steam is low. Both centrifugal gas exhausters and steam ejectors are provided.

Fig. 2. General view of the "A" power station, showing the low-pressure generator bay. The AEI sets are of 11·2 MW rating

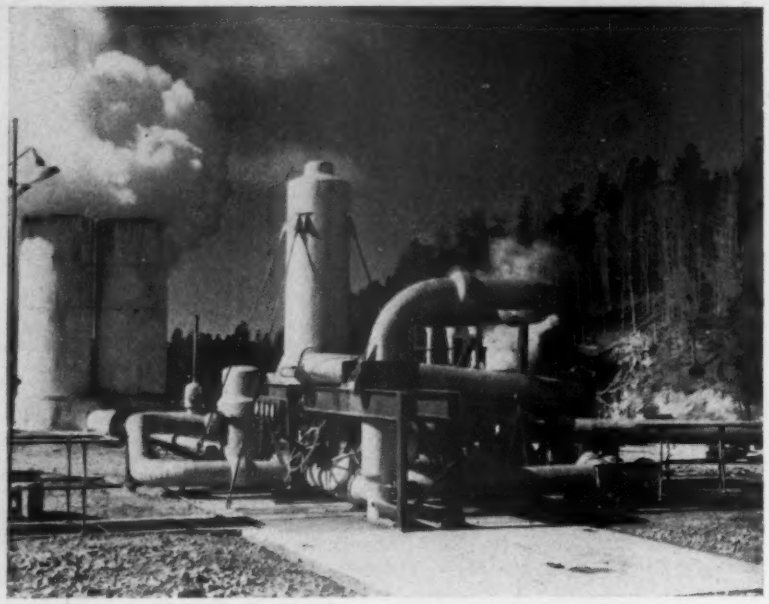


Fig. 4. Plant at a steam-producing well head. On the left is a twin-tower silencer, the separation of steam from water taking place in the equipment seen in the centre

Inter-bore Reaction

One of the uncertainties about the Wairakei scheme is how the abstraction of steam from one bore will affect its production in another bore. It has not been possible so far to allow all the bores at Wairakei to discharge freely, but groups of bores have been tested in this way. There is no evidence of reaction between those widely spaced, but there have been signs of some slight interaction in the case of bores which are close together. On this evidence, it seems that development beyond the 252 MW planned should be possible.

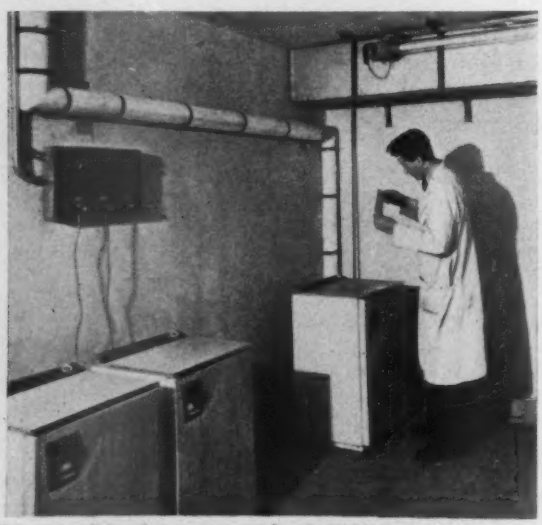
The New Zealand Government is extending its drilling programme at Wairakei, and the NZ Ministry of Works is at present carrying out a programme on a new location, Waiotapu, some miles away. In another area, Kawerau, steam is being produced for the paper industry.

It has been suggested in some quarters that the ultimate electrical potential of Wairakei and nearby geothermal sources is as high as 1,000 MW. A more cautious tone is adopted by those officially associated with the development, however. The Engineer-in-Chief to the NZ Ministry of Works, Mr C. W. O. Turner, has been quoted as saying that "While undoubtedly the resources are very considerable, no one can say how much power is available. This can only be definitely proven by drilling. A field must be probed and proved on an extensive basis. It is unwise to place reliance on the continued output of a bore without such extensive verification."

The NZ Electricity Department operates the Wairakei station and is responsible for electrical engineering there. Consultants are Merz and McLellan and Sir Alexander Gibb and Partners.

Refrigerator Test Room

AN air-conditioned test room has recently been brought into use at the Blythe Bridge factory of Simplex Electric. The room will be used for development and testing of domestic appliances, particularly refrigerators, for the home and overseas markets.



The air-conditioned test room at Simplex's Blythe Bridge factory in use for testing refrigerators. Air at the required temperature and humidity enters through the duct above the tester's head

For refrigerators, British Standards require that tests should cover climatic conditions varying between 60°F and 110°F dry bulb, with up to 75% relative humidity. For some domestic cooker components the requirements are even more stringent, requiring satisfactory operation in relative humidity up to 95%, maintained for 48 hr, to ensure freedom from surface tracking.

The test room constructed at Blythe Bridge is of brick with insulated and lined walls and ceiling. Air-conditioning is provided by an automatic plant installed by Carter Thermal Engineering. The system controls dry bulb temperature to within ±2°F over the temperature range 60°F to 90°F and relative humidity to ±2% over the range 35% to 100%. Air is first drawn through a washer where water sprays automatically adjust dewpoint to the required value. It then passes through a heater battery where dry bulb temperature is adjusted and finally through a low-speed fan for discharge into the test room through an overhead duct.

After circulating in the test room, used air is withdrawn through another duct, make-up air is added, and then passed through a 5-micron filter before being returned to the air-conditioning plant. An electronic control system is used to give rapid response to temperature or humidity variation and control dials give easy adjustment.

Trends in American power cable technology

by C. C. Barnes,* M.I.E.E., M.A.I.E.E., A.B.I.M.—Part 2

TRENDS in power cable design and utilisation in America were discussed by the author during a visit he paid recently to the USA. In the first part of the article, a recently established e.h.v. field testing station was described. Data from tests in manufacturers' laboratories indicate that the paper-insulated cables under test there will be capable of carrying loads of 500 MVA or more at a three-phase voltage of 345 kV or higher. This field testing programme may be expected to point to the limits of system voltage and power transmission capability for which oil-impregnated, paper-insulated cable is suitable.

Reference was also made in the first part of the article to other American work. In this concluding part, some of the research and development activities of American power supply companies is surveyed briefly.

Baltimore Gas and Electric Company

Epoxy Resin-Orlon Applications in Cable Accessories. Epoxy resin-Orlon is continuing to be used extensively in cable accessories. There are now close to 1,000 joints, terminations and repairs which were made with epoxy resin-Orlon in the underground system of the Baltimore Gas and Electric Co. and all are providing trouble-free service. New applications are being sought. The epoxy resin-Orlon was made standard for use in terminating 15 kV p.i.l.c. cable indoors in 1959, and outdoor weathering tests at two and a half times rated voltage are in progress at a location where the atmosphere is contaminated with industrial fumes, to determine whether these potheadless terminations are suitable for outdoor use. In 1959 arrangements were made with a supplier to manufacture and market the epoxy resin-Orlon formulations developed by the Baltimore Gas and Electric Co.

Calculation of "Ampacities" by Means of a Computer. A project was initiated in 1959 to develop a computer programme to make calculations required in connection with non-uniformly loaded and different types of cable. Whereas industry-sponsored current rating tables for uniform cable lines will be of some value, the usual situation in the Baltimore area is variety of cable types and sizes in a given line. The planned programme will be useful in calculating long-time or ultimate current ratings of the cables in a line, but of greater value is the fact that the speed and flexibility of the computer will permit repeated calculations of the current ratings of the cables in a line as conditions change, permitting more efficient utilisation of inherent cable capabilities. Thus, as cables are added or removed from a line, cable ratings can reliably and quickly be lowered or raised by the proper amounts. The programme has been developed to the stage where trial runs are now being made.

Consolidated Edison Co. of New York, Inc.

Oil Circulation in Pipe-type Feeders. The circulation of the oil in pairs of pipe-type feeders for temperature averaging has been adopted as a general principle for such feeders. Two pairs of feeders have been so operated for two years. Sixteen additional pairs were converted to this type of operation in 1960.

Reinforcement of Consolidated Edison-Long Island Lighting Company Interconnection. Two 8¼-mile 138 kV pipe-type feeders constitute the interconnection between Consolidated Edison and the Long Island Lighting Company. One, installed in 1958, has a conductor size of 900 MCM (0·71 sq in.), but the other, installed in 1948, had only 350 MCM (0·275 sq in.) cables. During the severest winter weather (March, 1960) the 350 MCM cables were removed and 900 MCM (0·71 sq in.) cables installed to increase the interconnection capability.

The feeder was preheated by controlled loading prior to de-energising for work in order to facilitate removal of the very viscous pipe oil. The 12-year-old compression cable and joints removed appeared to be in excellent condition. After cable removal the old oil was thoroughly removed with squeegees, and Suniso No. 6 oil was used for repressurising the line. Suniso No. 6 oil is now the only oil used in pipe feeders on the system.

Use of Jacketed Cable in Underground System. Lead-covered cables having a corrosion-protective jacket have been used on the underground system for a number of years where corrosion conditions are known to be severe. A recent study indicated that overall savings would result by standardisation on the use of jacketed cables for new installations and cable replacements throughout the 15 kV system. The use of jackets had, therefore, become the standard for cables in this voltage class on the system.

Welded Aluminium Joint Sleeves on Aerial Cable. The use of 15 kV, three-conductor, 500 MCM (0·39 sq in.), paper-insulated, aluminium-sheathed, gas-filled aerial cable has continued on the Consolidated Edison System. Whereas joints have previously been made by using mechanical-type closures on the aluminium sleeves, aluminium joint sleeves with welded closures have now been developed. This development was rendered somewhat difficult due to the desire to connect the solid wall gas tubes internally to the nipple on the joint sleeve.

The Detroit Edison Company

Compound Drainage Tests on 138 kV HPGF Cable. Based on the results of accelerated load cycle and voltage tests recently completed, it has been concluded that no troubles should be encountered in service with 138 kV HPGF pipe cable impregnated with Oronite 32 (300 SUS at 100°C) compound due to compound drainage. The cable on test *was subjected to over 2,500 load cycles (room temperature to 100°C) while operating at 69 kV to ground.*

Pressure Filling of Potheads. In an effort to minimise pothead troubles attributable to improper filling with compound, a pressure compound filling method has been developed and approved for future use for potheads on the Detroit Edison Co's 4·8 kV and 13·2 kV distribution system. The pressure filling equipment utilises an elec-

* Mr Barnes is with the CEGB. Part 1 of this article began on p. 177, 10 August issue.

trically heated container which heats the asphalt compound to the desired temperature prior to and during transportation to the field installation. Facilities for force-feeding the compound into the pothead are incorporated into the device. Examination of trial installations indicate that potheads filled by this method are completely filled with compound.

Routine Testing of 4·8 kV Distribution Cables. Routine Kenetron tests at 40 kV were continued during the year on paper and lead and v.c. and lead cables in service on Detroit's 4·8 kV distribution system. Examinations of the cable test failures revealed sheath troubles which would have ultimately resulted in cable service failures. Likewise, examination of pothead test failures revealed moisture which no doubt would have caused subsequent service troubles.

Pacific Gas and Electric Company

Compact Round 1,250 MCM Conductors for Pipe-type Cables. Preliminary studies for a 3·3 mile 115 kV pipe-type cable circuit indicated that a 1,000 MCM (0·79 sq in.) compact segmental conductor (although somewhat marginal) would handle the load requirements, including future load increase. In checking estimated cable costs with various manufacturers it was found there was about a 20% price increase for providing a given size conductor in compact segmental form. This led to a cost and ampacity study of non-segmental conductors that could be pulled without the necessity of increasing pipe size. It was found that a 1,250 MCM (0·985 sq in.) compact round cable would cost about 5% less than the 1,000 MCM (0·79 sq in.) compact segmental and, at the same time, a 5% increase in current-carrying capacity might be obtained. Prior to final acceptance and in order to verify preliminary calculations, the cable manufacturer made a sample length of cable and laboratory tested the a.c./d.c. resistance ratio. A 20 ft length was also forwarded to the Pacific Gas and Electric Co's laboratory for general examination, checking flexibility and subjection to the AEIC cold bend test.

The results of all these tests were found satisfactory, consequently the manufacturer was authorised to proceed making this cable for commercial application. No difficulties have been experienced in pulling or splicing the cable in the field. It is believed that this is the first 1,250 MCM compact round conductor ever manufactured—at least in the United States.

Philadelphia Electric Company

Extended Use of Jacketed Paper and Lead Cable. Neoprene jackets for the protection of the lead sheath of paper-insulated cable from corrosion is standard practice for all cable purchased by the Philadelphia Electric Company. The increased cable cost is justified since savings resulting from the use of jacketed cable in known corrosive environments offsets the increased cost of neoprene jackets for all future installation, regardless of environment.

Soil Thermal Characteristics. The last AEIC Power Distribution Committee report included mention of tests on the effect of the distribution of grain sizes on the density of sands. The final test report indicated that an actual density increase of about 15% was achieved through modification of the grain size distribution of a quartz sand. Concurrent tests which one of the Philadelphia Electric Company's suppliers had been encouraged to make by the PE Co's interest in the subject, led to a comparable improvement, with the result that a backfill sand of greatly reduced resistivity is now available commercially.

The Challenge of the Future

The American electric power industry is growing rapidly. It has expanded from 57,000 MW of interconnected installed generating capability in 1948 to 175,000 MW today. In addition, there are some 20,000 MW in industrial and non-interconnected electric power facilities. By 1964 the national interconnected capability will reach 221,000 MW and it is believed that by 1985 they will require from 625,000 MW to 875,000 MW.

Growth has been reflected in the trend toward larger generating units. In 1950, units with a capacity of 125 MW were considered exceptional. At the beginning of 1961, United States power systems had on order and planned for installation 188 steam turbine generators ranging in size from 4 MW to 900 MW. Of these, 30 units are larger than 300 MW. Two 450 MW units are already in operation. On order are five 500 MW, two 650 MW and two 900 MW machines. The equipment manufacturers have said that they are ready to build as high as 1,000 MW units.

At the end of 1959, world-wide installed generating capacity was 500,000 MW. An address by Mr. W. L. Cisler, President of the Detroit Edison Company, contained the following viewpoint. "A special urgency will be imparted to the need for providing availability of ever-greater quantities of electric power by the high rate of population increase that many parts of the world are now experiencing.... This suggests most forcefully the urgent need that we will have for talented engineers and managers to carry forward the development of electric power technology—because without sufficient energy, nothing else can be accomplished on the necessary scale."

One of the major fields of technical advance in the United States concerns the problems of transmission for the increasing quantities of energy that will be generated from now on. Population growth and the movement to the suburbs are making it increasingly difficult for electric companies to secure the necessary rights of way for lines.

In some parts of the United States, metropolitan areas surrounding large cities are becoming continuous from one city to the next. The American ideal of individual home ownership tends to spread their population over the land, literally one or two storeys high. Necessary streets and highways to serve this spread of population, to interconnect market areas and to move materials between industrial plants, are also taking up ever more space.

Such factors, together with the development of interconnections between electric systems, emphasise the need for efficient long-distance transmission. One transmission circuit at 400 kV can carry approximately the same amount of power as ten circuits at 120 kV.

It has been demonstrated during the past decade that overhead transmission voltages ranging from 345 kV to 600 kV are technically feasible. In the United States, well over 3,000 circuit miles of 345 kV transmission lines are now in operation. To advance understanding of extra high voltage phenomena, the General Electric Company,[15] with the co-operation of equipment manufacturers, has set up a prototype power system in Massachusetts for overhead transmission research at 460 kV to 750 kV.

Acknowledgments. The author is greatly indebted to many American engineers for their kindness and consideration shown during the numerous interesting discussions which ensued during his visit.

Acknowledgment is also made to Mr. J. L. Egginton, Chief Tranmission Engineer, Central Electricity Generating Board, for permission to publish this information.

(Concluded)

REFERENCE

16. "Project E.H.V. Energised at 460 kV to 750 kV," *Electrical Engineering*, February, 1961, Vol. 80, No. 2, p. 161.

Replacement of Electric Motors

INTERCHANGEABILITY OF C.R.P.O. AND C.M.R. TYPES IN SERVICE

by J. L. Watts, A.M.I.E.E.

THERE are many occasions when it may be necessary to replace an existing motor by a new one, through breakdown, general deterioration, alteration of driven plant or processes, or for other reasons. It is then important for the electrical engineer to be able to compare the capabilities of the old and new machines, as listed in the specifications applicable to them.

Temperature Rise and Ratings

Many modern motors have a greater temperature rise on full rated load than older machines of the same type h.p. and speed, and quite often have a smaller frame size. The increased temperature rise may be due to two factors; first, the use of insulating materials, which are capable of operating at higher temperatures, and, second, the newer methods of rating motors.

BS 2613:1957 gives the permissible temperature rise, measured by thermometer, of windings insulated with Class A, E, B, F and H insulating materials as 55°C, 65°C, 75°C, 95°C and 115°C, respectively, with cooling air temperature not exceeding 40°C. In the case of a motor, other than totally enclosed, built to BS 168:1936, the permissible temperature rise of the windings on full rated load is 40°C for Class A insulation and 50°C for Class B insulation or totally enclosed motors with Class A insulation.

It should be noted that the temperature rises quoted from BS 2613 are the maximum permissible temperature rises applicable to motors operating with a cooling air temperature not exceeding 40°C. If the cooling air temperature is lower, the life of the motors may be prolonged as a result of lesser maximum temperature attained by the insulation, but possible increases of load and temperature rise when operating with cooling air at a lower temperature are *not* intended. If the temperature of the cooling air exceeds 40°C however, the permissible temperature rise should be correspondingly reduced. This may mean operating the motor on less than full rated load if it has not been designed for use in high ambient temperatures.

We may, in fact, be moving into an era of hot motors. There is no inherent disadvantage in this, provided that the insulation, lubricants, etc., are capable of functioning satisfactorily at the temperatures to which they are subjected. Insulation designed for high temperatures often has advantages where a large h.p. motor is to be installed in a small space or the motor is to operate in a hot location.

Overload Capacity

An important point is that except in the case of totally enclosed and short-time rated motors, BS 168 refers to motors having a continuous rating permitting overload (c.r.p.o.). Such c.r.p.o. motors to BS 168 are capable of the following overloads, after attaining the temperature rise corresponding to their rated load, voltage and frequency, where the temperature of the cooling air does not exceed 35°C:

25% overload in torque for 2 hr for sizes of 10 h.p./1,000 r.p.m. and upwards.

25% overload in torque for ½ hr for sizes below 10 h.p./1,000 r.p.m. and down to 4 h.p./1,000 r.p.m.

25% overload in torque for ¼ hr for sizes below 4 h.p./1,000 r.p.m. and down to 1 h.p./1,000 r.p.m.

These values are shown graphically in Fig. 1.

On the other hand, motors to BS 2613 have a continuous maximum rating (c.m.r.), the rated h.p. being the maximum continuous load to which the machines should be subject. Thus, whilst a c.r.p.o. motor might be overloaded for a short time and may safely operate with a rather higher temperature rise than that corresponding to its rated full load, a c.m.r. motor may reach a dangerously high temperature if operated on more than its rated load.

Bearing in mind that the life of Class A insulation may be approximately halved for 10% increase in temperature in the hottest part of the windings, and the life of Class B insulation approximately halved for 12% increase of "hot-spot" temperature, it is necessary to ensure that a c.m.r. motor of adequate horse-power is fitted. This is particularly important when replacing motors which are not totally enclosed, or the higher h.p. low-speed motors of comparatively large frame size.

It is, of course, quite in order to replace a c.r.p.o. motor of a given type, h.p. and speed by a c.m.r. motor of the same type, h.p. and speed, providing that the motor is never required to carry more than its rated full-load current, apart from momentary periods such as during infrequent starting, though the increased temperature rise of the c.m.r. motor may give a rather shorter life than the c.r.p.o. motor.

Effect of Low Voltage

When installing a motor which is rated on its maximum output, it is necessary to make quite sure that conditions will never demand greater loads. For example, it must be remembered that the current taken in developing rated h.p. will increase if the voltage falls below rated

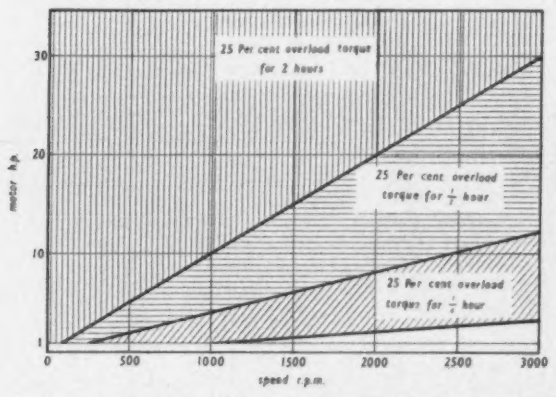


Fig. 1. Overload capacity of c.m.r. motors, other than totally enclosed, to BS 168, cooling air temperature not above 35°C

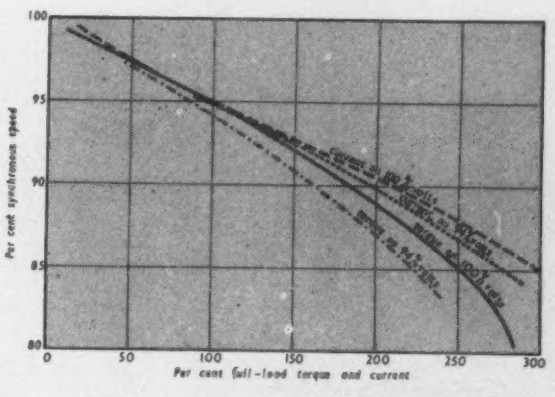


Fig. 2. Effect of reduced voltage on speed, torque and current in a typical three-phase squirrel cage motor

value. From Fig. 2 it can be seen that, if a squirrel-cage motor is run at 94% rated volts, its full load speed will be slightly less than rated speed. The motor will then take approximately 107% of full-load rated current.

If, therefore, a motor is to operate on its c.m.r. rating, it should not be designed for a voltage greater than that of the supply. Furthermore, the cables to the motor should be so chosen that they do not produce an excessive volts drop at the motor terminals. If the supply voltage is subject to considerable variation, it may be advisable to install a motor having a rather greater h.p. than the load requires to ensure that, even on reduced voltage, the motor will take no more than its rated full-load current.

Duty Cycles

Obviously, if subject to occasional overloads, it may be necessary to use a c.m.r. motor of somewhat greater h.p. than would be the case if the motor had a c.r.p.o. rating. Neglect of this precaution has resulted in dissatisfaction when an overloaded c.r.p.o. motor has been replaced by a c.m.r. motor of slightly greater h.p. it being found that the temperature rise of the new motor, having the same class of insulation, was as great as that of the c.r.p.o. motor.

Certain duty cycles may call for widely varying loads and these may call for a c.m.r. motor of somewhat greater h.p. than would be the case with a c.r.p.o. motor. Some drives may take a slightly greater h.p. for a short time after a prolonged stoppage; in other cases a motor may occasionally have to start against load after having tripped out.

It might be found, for example, that a 115 h.p., three-phase, 415 V c.m.r. motor (140 A full-load current) is required to drive a machine which had previously been driven by a 100 h.p. c.r.p.o. motor (125 A f.l.c.). Incidentally, the c.m.r. label raises the question as to whether some alteration of the wording of IEE Regulation 316(A) may not be called for. This requires that cables carrying the starting, accelerating and load current of a motor shall be at least equal to carrying the full-load current of the motor when rated in accordance with the relevant British Standard. It might be argued that a 37/0·072 multi-core p.v.c. cable in conduit (rated at 126 A) should be large enough for either motor since they are substantially the same machines and driving the same load.

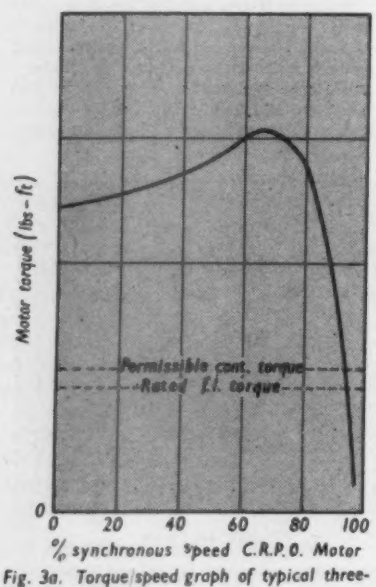


Fig. 3a. Torque/speed graph of typical three-phase c.r.p.o. motor

Table I

Rated horse power	Synchronous speed (r.p.m.)	Efficiency (%)	
		Full load	Half load
1	1,500	82	80
1	1,000	81	80
2	1,500	83	83
2	1,000	82	80
3	1,500	84	83
3	1,000	83	81
5	1,500	86	84
5	1,000	85	83
10	1,500	88	87
10	1,000	87	86
15	1,500	89	88
15	1,000	88	87
20	1,500	89	88
20	1,000	89	88
25	1,500	90	89
25	1,000	90	89

Measurement of Load

If a motor is to operate on its continuous maximum rating, it is essential that the requirements of the load be accurately assessed. Where an existing motor is to be replaced it is a fairly simple matter to calculate the h.p. required by measuring with a reliable ammeter the current input to the existing motor, when the required load is being taken, providing only that the motor is operating fairly close to its full-load rating. If the motor is supplied at its rated voltage the h.p. output may then be taken as the product of rated h.p. and measured current, divided by the rated full-load current.

If the motor is operated on less than its rated h.p., the current demand will not be proportional to the h.p. because of the reduced efficiency and, in the case of an a.c. motor, the much lower power factor on light loading. It may then be necessary to measure the true watts input to the motor and to calculate the h.p. output from this taking into account the efficiency of the machine at the reduced load. Table I may be taken as a guide to the efficiencies of typical four- and six-pole three-phase squirrel-cage motors. The h.p. output of any motor will be equal to the product of watts input and per cent efficiency, divided by 74,600.

It is, of course, necessary to ensure that misleading results are not arrived at through overlooking some pertinent factor. For example, the ammeter in a motor circuit may be inaccurate, or it may be connected to measure the total current to a motor with a parallel-connected capacitor for power factor improvement. In this case the ammeter reading will be *less* than the actual motor current. The ammeter should be connected to read only motor current, with the capacitor disconnected while the readings are taken.

In one instance, certain three-phase, 440 V motors became hot when driving new pumps. These had been designed to operate with a fairly low flux density since it was found that they ran at lower temperatures when the voltage was raised to 480 V. They were operated on this voltage for some years. It was eventually decided to replace them by new motors of standard (415) voltage, and to adjust the supply to that voltage. In calculating the h.p. requirements of the pumps, by measuring the current input to the existing motors, it had to be borne in mind that the reduction of motor temperature was due to the motor current being lower at the higher voltage, the actual h.p. output being approximately equal to the product of rated h.p., measured voltage and measured current, divided by the product of rated voltage and rated full-load current.

In case of doubt as to the power required under all conditions, it is wise to err on the high side when deciding on the size of motor. In any case, any extra cost of a slightly larger machine is likely to be repaid in the longer life obtainable at the lower temperature.

Heat Output

The actual amount of heat dissipated by a motor is proportional to its losses. If the efficiency is the same, the heat output of a c.m.r. motor of given size will be equal to that of a c.r.p.o. motor of the same h.p., although the c.m.r. motor may run at a higher temperature. Nevertheless, there may be positions in which it is inadvisable to fit a motor which runs at a high temperature even though it is designed to do so, because of proximity to operators or materials.

Starting Torque and Maximum Torque

The starting torque and maximum torque may also need consideration when

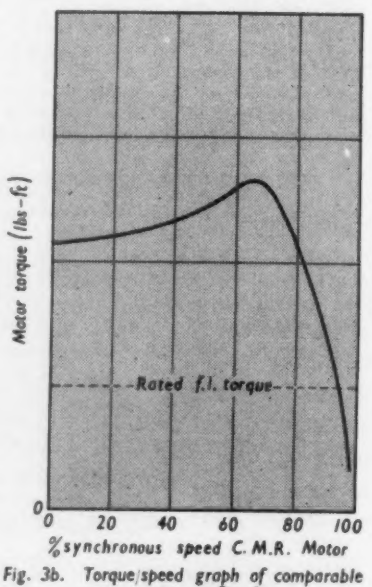


Fig. 3b. Torque/speed graph of comparable c.m.r. motor to Fig. 3a

installing a c.m.r. in place of a c.r.p.o. motor. The permissible continuous torque of a c.r.p.o. motor is slightly greater than its rated full-load torque, as indicated in Fig. 3a, and slightly greater than the permissible continuous torque of a c.m.r. motor of the same h.p. and speed. This is indicated in Fig. 3b. The new rating might, therefore, result in a given c.m.r. motor with a somewhat lower starting torque and maximum torque than that of a c.r.p.o. motor of the same design, h.p. and speed. This may be of importance in certain drives. These torques largely depend on the design of the rotor and the purchaser should make sure that the c.m.r. motor has adequate starting and maximum torque for the requirements of the load.

Protection

Protection and reliability are also important factors. In general, if a motor is to be operated close to its safe limit, it should be protected by overload releases set closer to the operating point than would be necessary for a motor operated on a lower proportion of its maximum continuous load. This may call for use of overload releases which can be relied upon to operate closer to their current setting than the ±10% allowed by BS 587, if the motor is to be adequately protected without risk of premature tripping.

Noise in Factories

UNITS OF MEASUREMENT AND SUPPRESSION TECHNIQUES

NOISE seems to be receiving more attention these days than in the past. In the factory, as outside, there appears to be increased awareness that the nuisance of noise can be reduced in many cases by careful application of relatively simple principles. The works electrical engineer is unlikely to be the worst offender in a factory from the noise aspect, but he needs to know something of the techniques and measurements involved in noise suppression, for his equipment is likely to be affected by the measures taken.

Noise has been simply defined as unwanted sound.* It is a form of energy which travels as a series of pressure waves or pulses. Thus, the intensity of sound is related to the pressure it sets up in the air. However, so far as the effect on human ears is concerned, direct measurement of pressure does not give immediately useful information. A common approach is to use "decibels," in which the figure given is ten times the logarithm of the ratio (actual sound intensity/intensity at the threshold of audibility). On this scale, an increase of 10 decibels (10 dB) corresponds roughly to a doubling in apparent loudness. The decibel scale may also be used to relate the intensities of two sounds.

A complication comes into evaluation of loudness, because how loud a noise seems to any one observer depends in part on the frequencies that make it up. If pure tones are involved, then, up to quite high sound levels (80 dB), higher frequencies sound louder than lower frequencies of the same dB value. A unit, the "sone," takes account of this variation with frequency in a way that permits direct addition of sone values where appropriate. 40 sones is twice as loud as 20 sones, etc. Fig. 1 shows how some typical factory sounds compare in terms of the two units.

Turning from the problem of stating noise levels to that of reducing them, two approaches are possible. Either the amount of energy being communicated to the vibrating surface that radiates the noise can be reduced, or the efficiency of the surface as a radiator of noise can be reduced. Most of the ways of reducing noise energy are well known, and boil down to the fitting of silencers, or the application of careful maintenance to ensure that the machine works sweetly.

How effective a surface will be as a radiator of noise depends on the relationship between its size and the frequency of the noise (and hence its wavelength). To radiate sound effectively at 100 c/s (transformer hum, for example) the source must be several square feet in area, but at 1,000 c/s intense sound can be radiated from a source of only a few square inches.

Where vibration is the cause of noise, as it may be in an electric motor, then the source itself may be too small to emit noise effectively. In such a case, however, conduit connected to the motor gives a rigid connection to a surface that can act as an effective radiator. A technique available for dealing with this case is to interrupt the rigid connection path with resilient material; though this must be chosen to have characteristics suitable to the frequencies involved.

Once noise has been generated and radiated, then the most effective way of controlling it is to contain it within an enclosure. In general, the noise level will be higher within the enclosure than it would have been otherwise, but elsewhere there is some benefit.

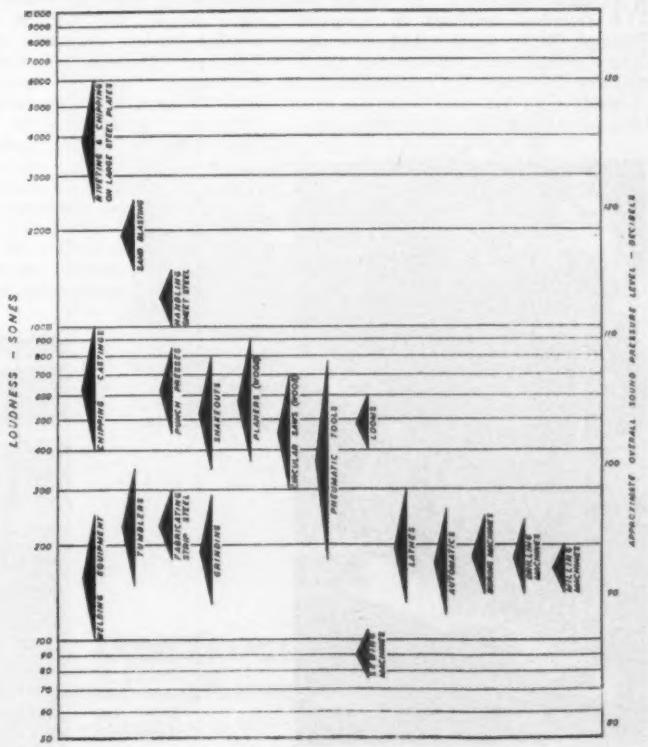


Fig. 1. Apparent loudness of some typical factory machines and processes

* The definition, the diagram, and much of the information in this article is taken from Factory Building Study No. 6, "Noise in Factories," published by HMSO, 3s 6d.

Automated Factory Progressing

NEW CENTRALISED SYSTEM TO SPEED OUTPUT

A NEW answer to the time-consuming —and often time-wasting—task of factory progressing lies in the "Productograph," a production control system which has been introduced here by Adrema Ltd., of Telford Way, W.3.

The control centre is linked with any number of machines, conveyors, flowmeters, etc., through rate transducers, interruption indicators and telephones, presenting to the controller a minute-to-minute picture of how flow is proceeding and of the precise position of bottlenecks, machine breakdowns or other checks to production in pictorial form by counters, light indicators and recorders. Each machine tool signals the completion of individual processes which are transmitted for indicating and recording, the latter clearly showing any gaps or uneven flow from the unit. A key-operated interruption switch enables the operator to immediately signal breakdowns, shortage of material, or other causes of standstill up to five, and a telecommunication link enables the controller to issue instructions to the operator or maintenance staff for rapid rectification. The recorder shows, on special waxed paper, two associated graphs for each machine; one is the production rate and the other is the number and causes of breakdown with time of incidence.

Control centre of the new "Productograph," designed to centralise factory progressing

All conversations and reports from works staff are tape recorded and the same instrument can issue operating instructions for night staff. The "Productograph," which was developed in Germany by Siemens Halske, would appear to have great possibilities in British production.

New Assembly Lines for Standards

MODERNISATION of the new assembly buildings at Standard-Triumph Group Services Ltd., Coventry, is now complete and incorporates one of the most up-to-date and revolutionary car assembly lines yet developed. Designed for a productive flow of 300,000 vehicles per annum on three levels, it covers three distinct lines for the production of five models, including the Herald, T.R. and Vanguard. The conveyors and mechanical handling equipment, by G. W. King Ltd., of Stevenage, includes "Mansaver" grabs to lower the bodies from store on to the conveyor lines, double-strand floor conveyors, the largest of which have sprocket centres of 363 ft, and slat conveyors, each with a wide range of speed regulation.

The control room for the system is located in the basement and the controllers are able to monitor the flow through 13 closed-circuit television links, five of which are permanently connected to 14 in. monitoring screens at the centre with a sixth which can be switched to any one of the remaining eight cameras. Since the picture is monochromatic, body colours are indicated by coded cards placed on each vehicle. Close liaison between the controller and the programming departments is maintained by Lampson tubes. The installation was designed in association with the Standard-Triumph Group planning engineers; the TV cameras, monitors and equipment were supplied by Marconi Ltd.

1 ton "Mansaver" grab lowering a car body on to the conveyor line

General view of the production line showing the double-strand "King" floor conveyors

Variac

REGD. TRADE MARK

FOR CONTROL OF **VOLTAGE**

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POWER

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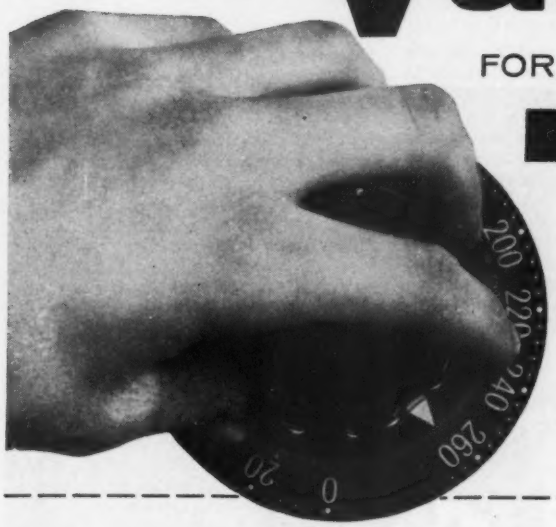

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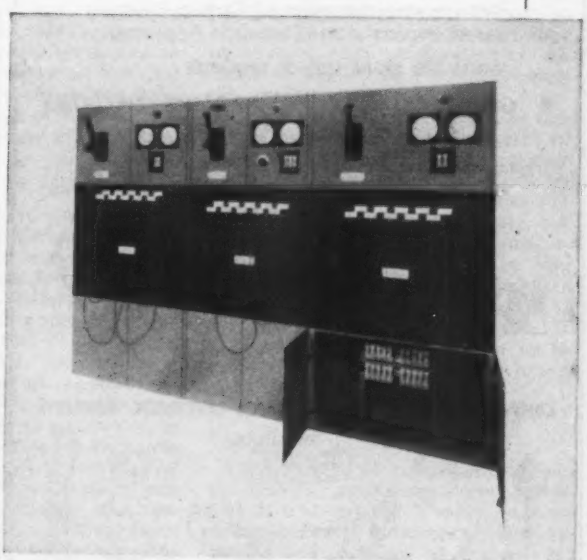

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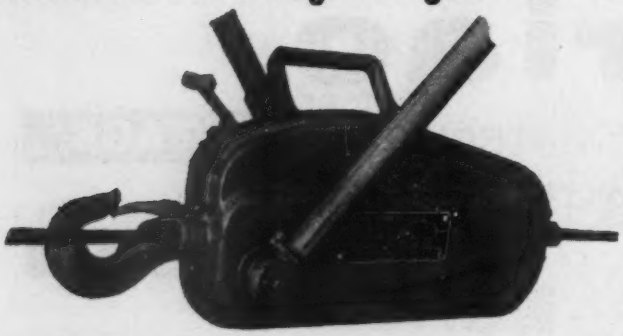

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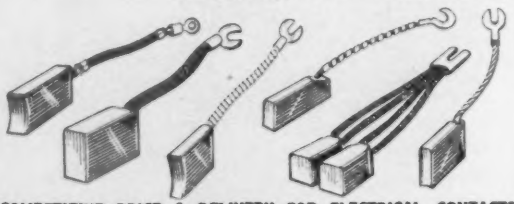

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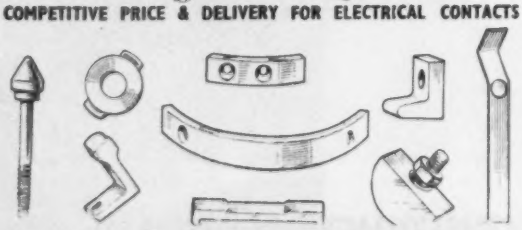

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B43a

Maintenance of Motor Control Gear

USEFUL REMINDERS IN NEW B.S. CODE OF PRACTICE

IT has often been said that maintenance is largely a matter of common sense coupled, of course, with some technical knowledge of the equipment being maintained. Though no one will argue with this, it is remarkable how often one manages to overlook the simplest things when planning or carrying out a maintenance programme. Even the most experienced engineer has recollections of occasions when he has omitted to deal with some small item with embarrassing after-effects.

While, therefore, the new BS Code of Practice on the maintenance of electric motor control gear* contains a great deal of plain common sense recommendations that even an apprentice should know, they suffer nothing in the restating. There are a number of reminders of the human weakness for using things and places for purposes not intended. How often do we find rooms and cubicles containing switches and control gear also serving as stores for quite unrelated articles? Yet, quite logically, the only articles which should be stored there are for use on and with the equipment. It is, in fact, quite contrary to statutory regulations to use switch rooms as general stores. And the tool which is missing at the vital moment would have been to hand if it had been regularly checked against inventory.

Manufacturer's Instructions

Another common failing is to ignore manufacturer's instructions until a breakdown occurs when, all too often, they cannot then be found. These instructions should be studied *before* the equipment is installed and every part familiarised so that, when trouble arises, one has some idea where to look for the failure and, of course, know where to place one's hand on the spare parts list.

After each breakdown, the incident should be recorded and analysed so that, on some future occasion, it, or similar incidents, can be more expeditiously handled—or even avoided if it can be traced to incorrect application or insufficient maintenance.

Changes in Service Conditions

There is one point at which most electrical maintenance engineers could be caught out. A change of drive, increased duty, additional load or other operational variation of a motor might take place without their hearing of it; for to the uninitiated it is not an electrical matter; why should they be told? But the change of conditions might well affect the setting of overload trips, increase the wear on control switches and contactors which, at the least, could call for more frequent maintenance or, at the most, a change to more robust control gear. It is not sufficient to leave mechanical maintenance staff to advise on changes like this; the electrical maintenance staff must continually be on the lookout for anything which may affect their responsibilities and report it, even though it may afterwards be decided that no action is necessary.

Safety of Personnel

Above all, it must never be overlooked that the voltages used in ordinary works distribution systems are lethal; not even the slightest risk of coming into contact with live metal may be taken. Though the main responsibility for the safety of anyone on the premises who is working with or on electrical apparatus legally lies with the occupier, common sense dictates that he cannot *personally* be responsible; he can only delegate the onus to one or more senior members of his staff who, in turn, will sub-delegate it to operatives as conditions dictate. Ultimately, it is the actual user who must take the greatest care. It is in this delegation that the risks are most likely to arise. To the electrician working on the switchgear and busbars, as well as the operative on the machine or tool, familiarity is only too often a lead to contempt. "It can't happen to me" has been the epitaph of many who have made the fatal mistake of underestimating the dangers of taking too little care.

Isolation

In most cases, maintenance work is only allowed to be carried out on equipment which has been made dead by a foreman or engineer-in-charge. Isolation can be by opening an isolating switch or by removing fuses. One must remember, though, that the action of isolating is incomplete unless it is followed by a check to ensure that the apparatus is "dead" and, preferably, to ensure that it remains so by earthing it. Opening an isolating switch by pulling on the handle is not, in itself, a sure guarantee that the blades have left the contacts; nor is the removal and retention of a fuse a guarantee that someone will not insert similar fuses from another source while one is away. The practice of inserting clearly marked dummy fuses, advocated in the Code, is both sound and simple. Nor must one overlook that the isolation of a main circuit to a control panel does not necessarily mean that it is all "dead." There may be interlock or alarm circuits still alive from another source.

Testing for "Live"

There may be occasions on which work adjacent to live equipment must be carried out and this should only be entrusted to experienced personnel who can be relied upon to take no risks. Even then, insulating barriers of a temporary nature should be set up wherever possible and, as a second precaution, a companion should be present the whole time whose sole function is to ensure that the operative is not endangered by passing obstructions and who is competent to take action should accidental contact with live metal take place.

When testing circuits for safety, not only is it advisable to use properly designed voltage indicators, but they must be tested on a known live circuit immediately before use. The widely used pair of test lamps in series employed on low and medium voltage circuits should be provided with a cartridge fuse in each lead (how many are?) and the leads must be properly and efficiently insulated up to the tips of the test probes. All other forms of improvised voltage tester should be rigorously discouraged.

Replacement Parts

An important duty of the electrical maintenance staff is the replacement of worn, broken or burnt parts of proprietary equipment. Apart from the purely emergency temporary repair to keep the plant running, only authentic replacement parts as supplied by the maker should be used. When ordering, the machine number and other nameplate particulars must be quoted, as well as the part number if this is given in the spare parts list. The wise engineer keeps a record of nameplate data in his office from the date of installation, not only as an easy means of reference, but also as an insurance against an inaccessible or defaced nameplate on the appliance. An easily overlooked corollary to this is to ensure that the record is changed each time the appliance is changed. Records which are not up to date are almost as useless as no record at all.

Cleanliness

Cleanliness is, of course, essential on all electrical equipment. Since a great deal of it is installed in dusty, or even downright dirty, locations, it must be cleaned and examined at frequent intervals. When removing dry dust, suction is better than blowing and, when blowing is inevitable, the low pressure portable blower is preferable to using that from compressed air pipelines. Wiping down should be done with lint-free cloth; cotton waste is quite unsuitable for electrical equipment, particularly over oil-

* British Standard Code of Practice, CP 1011 (1961), "Maintenance of Electric Motor Control Gear," British Standards Institution, 2 Park St, London W.1. Price 6s. The article summarises this.

filled containers where the oil is used for insulation. If degreasing is necessary, non-toxic and non-inflammable liquids should be used wherever possible. When the cover is removed to get at the contacts, external dust should be cleaned off first, and care taken to replace the cover.

Connections

A little point, but an important one which is so often overlooked, is the checking of terminals for tightness at each servicing period. No matter if they have not been touched in the operation, vibration and thermal cycling can loosen them—and a loose terminal eventually finishes up a hot terminal. Rarely is it that at least one of the terminations will not take a trifle more screwing down.

Insulation

The "Megger" insulation tester has long been used as the standard by which insulation resistance is tested, but an "infinite," or even a few hundred megohms, reading by itself is little real indication of the state of the insulation. Many other factors come into it, such as the area of insulation under test, type of insulation and age. It is only possible to judge the condition of insulation by comparing insulation resistance records over a long period; then a deterioration in resistance may truly be taken as deterioration in the insulation. Sometimes ambient conditions are also of relevance and the degree of humidity and/or temperature may be a qualifying factor in the reading; so they need recording.

Emergency Buttons

Emergency push-buttons are simple devices which may be overlooked during maintenance, but their failure at a critical moment may cost a life or cause serious damage. Other devices in the same category are limit switches used on hoists or cranes to prevent overtravel. The fact that they operated so infrequently in service is a potent reason for regular examination and cleaning.

Contacts are naturally the first things which come under observation in maintenance, whether they be the main or auxiliary contacts of starters or relays, or the butt contacts of push-buttons. Mostly they are of copper and pits should be removed with a fine file, finishing off with smooth glass paper. Emery paper should never be used, as the carborundum particles can embed themselves in the soft copper surfaces. Auxiliary contacts should receive just as much attention as main contacts and the secondary relay contacts, usually carrying much smaller currents, need no less attention.

Noisy Contactors

Magnetic contactors are also a frequent cause of trouble. If they are d.c., the chances are that they will not open smartly after some time in use; if they are a.c., then noise is usually the trouble

In each case, cleaning and oiling of the pivots is the answer. A "lazy" or sticking d.c. contactor may be due to a weak pull-off spring or an inadequate gap between fixed magnet faces and armature. The gap should be checked against the maker's recommendations. Rust or high spots on pole faces is the most frequent cause of a.c. magnetic contactor chatter. If cleaning is not the answer, there may be a shading ring on one pole face. Check if this is broken; if so, replace the unit or, in an emergency, replace the shading ring by a band of copper brazed at the joint. As for all emergency repairs, it should only be allowed in service until the proper replacement is obtained.

Capacitors

In these days when capacitors, both of the paper dielectric and electrolytic types, are to be found in most industrial installations, it is as well to maintain a small stock of spares. A point which may not be so widely appreciated is that, while paper dielectric capacitors can be stored indefinitely in an average dry stores, electrolytic capacitors deteriorate rapidly when not in use. Spares should, therefore, be kept permanently charged at their rated voltage with frequent recharging on a rota basis, or even kept connected across a charging rack permanently. All capacitors should be bench tested before installation by applying the rated voltage d.c. and, after a reasonable period of isolation, checked for retention of charge by discharging through a suitable resistor. There is one possible snag; the capacitor may already be fitted with an internal discharge resistance if it is of the paper dielectric type, in which case the "hold-charge" check will not be possible.

There are many other important reminders in the Code to which the experienced maintenance engineer will undoubtedly be able to add his own, for works maintenance is a subject on which volumes could be written. The Code, however, is a useful and practical reminder of many of the things which we may only overlook to our undoing. Certainly all of the younger members of the maintenance staff should study it carefully and diligently.

Care of H.F. Induction Equipment

THE use of high frequency induction and dielectric heating is now widely accepted in industry and there are many standard units in both types by various makers as well as special installations allied to particular industrial applications. Most of this equipment comes under the electrical staff for maintenance.

The routine maintenance which falls to the ordinary electrical service departments is largely confined to periodical cleaning and calls when the equipment fails to work for some reason or other. In the larger units, which use frequencies up to 50 kc/s, high frequency alternators are generally used and these call for the same sort of maintenance as most a.c. rotating plant. It is in the higher frequency generators incorporating thermionic valves that the average service electrician feels a little out of his depth, even though he may be armed with the servicing manuals supplied by the makers.

H.F. equipment falls into two broad classes, dielectric heating—in which the workpiece is of relatively high loss insulating material and forms the dielectric between two plate electrodes connected to the h.f. generator—and induction heating—in which the workpiece is heated by eddy currents induced by a coil surrounding or adjacent to it in which the h.f. current flows. The former uses frequencies between 2 Mc/s and 200 Mc/s; the latter uses frequencies rarely exceeding 1,000 kc/s, but generally much lower.

Thermionic h.f. generators are based on a self-oscillatory circuit, the larger outputs being obtained from pairs connected in push-pull arrangement. Connection to the workpiece terminals or coils is either by tight-coupling, in which there is electrical contact with the oscillator output coil, or loose-coupling, incorporating an inductive link effectively isolating the workpiece from direct electrical contact with the oscillator. The valves may be air-cooled or water-cooled. The life of the valves is limited to the life of the heating filament or its emissive covering. For induction heating, the coil surrounding the workpiece is water-cooled and provision is usually made for ensuring that the h.t. is not applied until the water is flowing. Other protective devices ensure that the high voltage d.c. potential is not applied to the valve until the cathode has warmed up to the emissive state.

Routine maintenance can usually be confined to the weekly blowing out of dust from the equipment enclosure, cleaning the surfaces of the h.t. insulators and checking the condition of contacts, water connections and fuses, all of which must be done with the equipment dead. Where a valve life indicator is fitted, this should be read and the number of hours in service recorded. In the event of a breakdown, check that the fuses are intact and that supply is available at the primary terminals of the h.t. transformer switch (with the switch open, of course), that the valve cathode heater is receiving its correct voltage, cooling water is flowing, and that all interlock contacts are operable. Interlocks vary with different designs, some including a timing device, and the details are to be obtained from the manuals supplied. Trouble in the oscillator circuit should be referred to the makers, who will get a skilled service engineer on the spot in the minimum of time.

AROUND THE TRADE

BY PEREGRIN

I SUPPOSE by now the industrial districts have finished their various holiday fortnights and life is back to normal. Trade during these holiday periods is unpredictable, but I found that pre-Bank Holiday wedding present buying accounted for a bigger share of cash trade than last year, also a greater number than I expected of holidays-at-home customers decided to treat themselves to a refrigerator or TV set. The new battery-operated shavers made top sales both for wedding presents and holiday makers; for although many hotels have made provision for electric shavers, it is not always so. I can remember one classic occasion when I shaved each morning in the telephone booth—the only place in which I could plug in without using screwdriver and pliers. Transistor radio sets also helped to keep the till ringing. So much so, in fact, that the "man who knows too much" in the *Daily Sketch* announces that chemists' shops, stationers and the local grocers may soon be selling them; they are so simple that the manufacturers consider specialist dealers are no longer needed. I have often wondered why so many traders seem anxious to cash in on electrical and radio goods, but I had never before realised that the manufacturers were so deliberately to blame; rather I suspected the wholesalers when I found electric irons in drapers' shops and fairy lights among the sweets. There seems no pattern in retailing any longer and, now that W. H. Smith's have cut out their lending libraries and tea rooms in favour of gramophone records, I may decide myself to go into ties, socks or even Wimpeys. It would be nice to have something selling like hot cakes.

Lighting Development

I see that Philips have joined the very lucrative field of lighting fittings and table lamps with some quite unusual designs. I have a feeling for the traditional, myself, but I must confess these white jam jars, halos and pudding basins have a line of their own and, while new at least, they look clean and attractive. So many of the "political prisoner" type of modern fittings soon become off-white and tatty looking. Selling fittings soon increases one's lamp sales—if sales assistants can be persuaded to remind customers of their necessity when acquiring a new fitting—and I find that the sales of candle lamps have increased rapidly over the last few years; so also has the sale of the new Neta bulbs. But these Neta bulbs are now causing many contractors and retailers furiously to think because of the heat they generate in so small an envelope. Apart from the danger of their becoming too hot to handle with safety, the temperature inside an enclosed globe may rise well over 200°F which, in addition to overheating the lampholder, is bound to affect the flex or cable into it with possible disastrous results. Bakelite lampholders were surely never intended to cope with such temperatures. It seems a very short time since the ivory bakelite holder would not stand up to the heat generated by the old type 100 W lamp in an open shade. The spoiling, or even destruction, of fabric shades by the heat from the Neta bulb seems a very minor trouble when one considers the possibility of fire from cooked flexibles and cables and I wonder who would be legally responsible if fire was caused by such overheating. It could quite conceivably be the contractor or retailer who installed fittings using such bulbs. Perhaps some more legal mind than mine might clarify this point.

P.T. Adjustments

Retailers have been concerned this last week or two with the adjustment of prices following on the Chancellor's "Little Budget," and by every post new price lists have trickled in to save him some office work. But I cannot help wondering why some of the manufacturers took the trouble. Why could they not have recognised the "nuisance value" of this increase and carried it themselves? Take lamps for instance, with the odd ½d added here and there to annoy the public and confound the retailer. It makes one wonder whether the addition of these increases was taken at top level or was just an automatic move to pass the buck by those firms which have already added the increase and are expending the extra on printing new price lists. Or is it that profit margins are so narrow that the increase must be passed on from sheer necessity? From the reports on trading which are issued by manufacturers from time to time one would hardly judge it to be that. And I do hope no one will trouble to point out that the increase is on the purchase tax, not the goods—I know that—but I, with many others, do appreciate the action of those manufacturers who have advised us that this small extra cost will be covered by adjustment to their list prices—a gesture for which we tender our thanks.

Guarantees

I see from Shoppers Guide No. 21 that car guarantees are receiving a little publicity. Perhaps the cold wind of criticism would do no harm in the electrical field as well, although I think the motor-car industry has been more completely implacable against waiving their rights under the terms of a guarantee than the electrical and radio manufacturers. But it is time that guarantees were given more thought. Why should the replacement of a 6d resistor, bearing, contact or washer absolve the manufacturer of all responsibility when the time to replace that part may be 12s 6d or even more? There is a constant traffic in such items as spin dryer switches and kettle elements which the customer expects to be fitted free of charge, and I can remember one case of three separate journeys of six miles each to fit two new pilot bulbs and a hot-cupboard hinge spring on a month-old cooker. The customer thought, quite rightly, that with an article of that price these repairs should be free; the manufacturer considered the replacements to be all they should reasonably be expected to do—the time was the responsibility of the contractor to be met out of his gross profits—of 15%! Even at 25% it is too much.

I think there should be a standard scale of allowances for fitting replacement parts under guarantee, to any recognised dealer willing to undertake the work. It is already being done by some of the shaver manufacturers and is working quite well and it can save the great expense of setting up special service departments all over the country.

Personalities *in the industry*

Mr C. J. R. Blackett

Mr E. Madders

Mr W. G. Thompson

Mr N. Care

Mr J. G. Reeves

Assuming control of SWEB's second largest district, Exeter, is **Mr C. J. R. Blackett**, A.M.I.E.E., A.M.B.I.M. (ESH, pages 100 and 102), whose appointment as district manager takes effect from 1 Sept. He succeeds **Mr F. Richardson,** ASSOCIATE I.E.E. (ESH, page 100), who has been appointed district manager for Bristol. Mr Blackett has been district commercial manager for Bristol South for the past seven years and, before that, he was Bristol district engineer. He has served the supply industry since 1935 when he joined Bristol Corporation Electricity Department. During that time he was control room engineer at Portishead power station for two years before joining the mains department, where he rose to senior mains assistant engineer.

Richardsons, Westgarth Ltd. have announced that **Mr A. D. McN. Boyd** has been appointed a vice-chairman (executive), and **Mr G. L. Hunter** has succeeded **Mr J. R. Mackay** as managing director of the group.

GEC Ltd. have appointed **Mr E. J. Aaronson,** F.C.A., to be their general manager for overseas operations. He was previously economic and financial adviser (export).

Senior lighting engineer at Sheffield for the past five years, **Mr E. Madders** has been appointed Sheffield area superintendent of AEI Lamp and Lighting Co. Ltd. on the retirement of **Mr W. G. Thompson.** Mr Madders, who joined Metropolitan Vickers Electrical Co. in 1927, moved to the company's Leeds Lamp Department four years later and to the Manchester office in 1933. He became a lamp salesman and lighting engineer there after three years and, at the end of the war, returned to Leeds as lighting engineer. Later he moved to Sheffield as lighting engineer. Mr Thompson, who has been with the company 50 years, was superintendent, Sheffield area, for the past seven years. He is past-president of the IES Sheffield Centre and the Association of Mining, Electrical and Mechanical Engineers, York South East branch. Joining British Westinghouse EM Co. Ltd. at the age of 14, he was appointed superintendent of the Sheffield office of the Metrovick company, in 1934, and retained that post when AEI Lamp and Lighting was formed in 1955.

The Minister of Power has reappointed **Sir William Holford,** F.R.I.B.A., M.T.P.I., as a part-time member of the CEGB. He has been Professor of Town Planning, University College, London, since 1948.

Rank Cintel Ltd. have appointed **Mr W. E. Taylor** assistant manager of their Electronic Tube Division. He has been connected with the electronics industry for several years and before joining Rank Cintel he was with AEI as sales manager of their Industrial Valve Department.

Director of the Honduras national electricity undertaking, Empresa Nacional de Energia Electrica, **Sn Luis Bogran Fortin** arrived in this country last Saturday for a ten-day visit. He is in the UK as guest of the Government and, during his stay, he will meet Government officials and representatives of British industry. He will also visit factories making electrical generating machinery, switchgear and other related products.

Formerly head of the Flight Research Department of the Bristol Aircraft Co., **Mr G. D. Taylor** has become chief applications engineer for Epsylon Industries Ltd. He joined Bristol Aircraft as a flight research engineer from Leeds University in 1949.

Director and general manager of Cossor Instruments Ltd., and past president of SIMA, **Mr L. Woodhead** has accepted the chairmanship of the organising committee of the International Instruments Electronics and Automation Exhibition. This is due to be held at Olympia from 28 May to 2 June next year. He succeeds the late **Mr Philip Canning.**

The appointment of **Mr N. Care,** M.I.E.E., as general sales manager has been recently announced by Aberdare Holdings Ltd. He will control the whole of the sales activities, both at home and abroad, of the manufacturing companies in this country which form part of the group. Mr Care, who became general manager, South Wales Switchgear Ltd., in 1957, has had wide experience of the supply industry. **Mr J. G. Reeves,** A.M.I.E.E., who has been appointed industrial sales manager of Aberdare Holdings, will co-ordinate home sales in the industrial field for the group.

Following the creation of the Kelvin Hughes Division of S. Smith and Sons (England) Ltd., divisional board appointments have been made. **Mr Ralph Gordon-Smith** becomes chairman with **Mr G. S. Sturrock** as deputy chairman. **Mr F. W. Bates** has been appointed general manager and **Mr C. G. White** sales director. **Mr A. T. Pye** and **Mr R. M. Stephenson,** responsible for home sales and overseas sales, respectively, are also appointed to the divisional board.

Previously with British Insulated Callender's Cables Ltd., **Mr A. G. Sweetland** has joined Cable Covers Ltd. as technical development manager. With BICC he held a number of senior technical appointments. Following a period as assistant to the deputy chief engineer, he was appointed to the Accessories Division in 1953 as assistant chief engineer to

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**Denotes revision to the "Electricity Supply Handbook, 1961."*

form a development department, and following completion of the laboratory was responsible for many significant developments in the field of accessories for mains cables, overhead lines and railway electrification systems. In this work he made noteworthy contributions to the application of glass reinforced plastics to engineering applications, particularly in the development of outdoor high voltage insulators. In his new capacity with Cable Covers Ltd., Mr Sweetland will be responsible for co-ordinating advancements in the field of electrical accessories and generally promoting the interests of the Power Engineer's Equipment Division.

Mr W. S. Sinclair has been appointed manager of the Cardiff office of the Incandescent Heat Co. Ltd. He has been with that concern for 12 years.

Mr M. Rose has joined Sunbeam Electric Ltd. as area manager for the Midlands region. Earlier, he had served with Ada (Halifax) Ltd. and Kenwood Manufacturing (Woking) Ltd.

Mr S. Glass has joined the Homeshade Co. Ltd. and has been appointed general manager of their new showrooms at 60-62 Mosley St, Manchester, which will be officially opened on 18 Aug.

Appointed senior assistant engineer (distribution design) of the Sheffield sub-area, YEB, is **Mr K. V. A. Lilley,** A.M.I.E.E., A.M.B.I.M., who succeeds **Mr J. K. Kent,** M.I.E.E., A.M.B.I.M., on his appointment to the headquarters staff of the CEGB in London. Mr Lilley, who was a student apprentice with the Colchester Corporation Electricity Department, joined the EEB as junior mains engineer, Colchester district. He was appointed to the Sheffield sub-area, YEB, in 1951 in the distribution design section and has held successive posts in that section prior to his present appointment.

Mr R. Walker has been elected a director of Marryat and Scott Holdings Ltd., and has relinquished the office of secretary of the company. He is succeeded in the latter position by **Mr A. J. Bryant,** F.C.A.

Formerly northern manager of the Electrical Appliance Division of Easiclene (1938) Ltd., **Mr J. Judge** has joined the Kenwood group as northern contracts manager. Well known in the trade in the Midlands and north of England, he served an electrical engineering apprenticeship and started his selling career with Hoover Ltd. Subsequently, he served with Wilkins and Mitchell Ltd.

Mr K. V. A. Lilley

Mr J. Judge

Mr J. P. Engels has been appointed managing director of Philips Electrical Ltd. in succession to **Mr G. F. Hofman,** who has reached retiring age after 40 years' service. Mr Hofman will continue to operate in an advisory capacity as a consultant until the end of the year. Mr Engels, who has been with the British concern for the past six months, was previously with the parent company in Eindhoven.

Previously operation superintendent, **Mr H. L. Mathews,** B.SC.(ENG.), A.M.I.MECH.E., has been promoted to deputy station superintendent at Northfleet power station, South Thames Division, CEGB. He succeeds **Mr E. H. Boyce,** A.M.I.E.E., A.M.I.MECH.E., M.B.I.M., A.M.INST.F., who is now station superintendent at Richborough.

Miss G. S. Geeves, SEB's senior demonstrator at Oxford, has been awarded a travelling scholarship by the Caroline Haslett Memorial Trust to enable her to study developments in domestic electrification in France.

Formerly export manager of E. K. Cole Ltd., **Mr T. C. Cleveland** is director and general manager of Ekco Export Ltd., a new company formed by E. K. Cole Ltd. to handle the export of radio, TV and car radio receivers, electric heating and plastics products made by the group. The other directors are: **Mr W. M. York** (chairman), **Mr J. Corbishley,** F.C.A., and **Mr D. J. Cole,** B.A., LL.B.

Mr S. S. Eriks, managing director of Mullard Ltd., has been appointed an honorary Knight Commander of the Order of the British Empire "in recognition of his valuable services to British official interests." Mr. Eriks, who was born in Oosterzee, Holland, joined N. V. Philips, Eindhoven, in 1924. After several overseas posts for the company, he was appointed general manager of the Mullard company and later director. During the war, all the Philips interests in Britain were integrated into the war effort under Mr. Eriks. When contact with Eindhoven was resumed after the war, Mr. Eriks became managing director of Mullard Ltd., and also chairman of Philips Electrical Industries Ltd., which administers N.V. Philips' interests in the U.K.

A memorial service for the late **Mr A. E. Iliffe,** formerly chairman of The Benjamin Electric Ltd., is to be held at the Church of St. Sepulchre, Holborn Viaduct, on Monday, 4 Sept., at 12 noon.

OBITUARY

Well known in the Midlands both as industrialist and politician, **Mr Walter Higgs,** M.I.E.E., chairman of Higgs Motors Ltd., died at his home last week, aged 75. He and his brother started the company in 1912 with a staff of seven and built it into one of the largest electrical motor firms in the Midlands. He gained early experience of the electric motor industry with GEC Ltd., BTH Ltd. and the Electric Construction Co. A former president of the Birmingham Chamber of Commerce and life governor of Birmingham University, he began his political life with the City Council and entered Parliament in 1937. He was a member of the House of Commons Select Committee on National Expenditure from 1939 to 1943.

Former deputy district manager of the Thanet district SEEB, **Mr C. H. Fagg,** died recently, aged 72. He served 49 years in the electricity supply industry with the Isle of Thanet Electric Tramways and Lighting Co. Ltd. and its successors until his retirement in 1954.

Personnel manager of Telegraph Construction and Maintenance Ltd., a member of the BICC Group, **Mr W. R. J. Martin** died suddenly on 30 July, aged 56. He joined the Telcon organisation in 1918 and became personnel manager in 1946.

Mr C. W. Haycroft, area manager in the Midlands for the Electrical Division of Radiation Ltd., died on 9 Aug. while on holiday in Cornwall. He was 48 years of age. He joined the Jackson Electric Stove Co. after the war as a representative in the London area.

BOOKS RECEIVED

Lead and Lead Alloys for Cable Sheathing, by S. A. Hiscock. Detailed study of production properties and applications of lead cable sheathing. Published by Ernest Benn Ltd., 361 pages, 9 in. by 5¾ in. Price 70s.

The E.A.W. Electrical Handbook. Complete revision of the handbook, which covers general principles of electricity, tariffs and methods of charge and practical domestic appliances. Published by the English Universities Press, 312 pages, 7¼ in. by 4¼ in. Seventh edition. Price 15s.

Electronics—A Bibliographical Guide, by C. K. Moore and K. J. Spencer. Lists major works in electronics literature. Published by Macdonald and Co., 411 pages, 9¼ in. by 7¼ in. Price 65s.

Works Accident Statistics, Part 2, Records and Analysis. Notes on how best to establish satisfactory accident recording system and how to prepare statistics from the records. Published by Royal Society for the Prevention of Accidents, 38 pages, 8¼ in. by 5¼ in. Price 5s.

Loch Awe scheme to have reversible 100 MW units

N.S.H.E.B. ORDERS SINGLE STAGE PUMP/TURBINES

CONTRACTS for the construction and installation of four 100 MW motor/generator, pump/turbine sets have been placed with AEI and English Electric by the North of Scotland Hydro-Electric Board. The plant will be installed at the Cruachan pumped storage station which forms part of the Loch Awe scheme. This station is to operate under a gross head of 1,177 ft and will have an estimated output of 450 million units per annum. The Loch Awe scheme also comprises two other conventional hydro-electric stations: Inverawe, with a 25 MW turbine-alternator unit, will operate under a head of 118 ft obtained from a catchment area of 324 sq miles, and Nant, with a 15 MW unit operating under a head of 564 ft from a catchment area of 17 sq miles. The catchment area for the Cruachan plant is 10 sq miles.

The Cruachan station will be situated underground in Ben Cruachan. At times of low electricity demand the 400 MW plant will pump water from Loch Awe, 120 ft above sea level, to a storage reservoir formed in a corrie, or hollow, on the side of Ben Cruachan. A dam across the corrie will allow the water level to rise to 1,300 ft above sea level. To meet peak demand, water from the reservoir will flow through shafts in the mountain to drive the hydraulic units in the power station as turbines. From the power station, water will be returned to Loch Awe through a tail race tunnel.

Will Supply Peak Load

The Loch Awe scheme will provide peak load power for the South of Scotland more cheaply than would be possible by constructing a new steam station. It will also enable high merit plant to operate at off-peak times to provide the pumping power at steam stations which would otherwise be idle.

Two of the units are to be manufactured by AEI and two by English Electric. The generator/motors, voltage-regulating equipment and control gear for the AEI sets will be manufactured at the Rugby and Glasgow factories, while the pump/turbines are to be subcontracted to Boving and Co. However, these are to be constructed almost entirely by John Brown on Clydeside. Each electrical machine will be rated 100 MW as a generator and 120 MW as a motor and will run at 500 r.p.m. They will operate at 16 kV, three-phase, 50 c/s. The machines will have a vertical shaft with a single-thrust bearing mounted in the upper bearing housing, designed to take the combined weight of the rotor and hydraulic runner and also the hydraulic thrust. This bearing will be of the spring mattress type with pressure lubrication. Two guide bearings will be provided, one in the upper bearing housing and one below the rotor. Two features of the AEI machine are unusual. The stator cores are to be constructed of a recently developed, low-loss, cold-reduced sheet steel which is stated to have a surface finish sufficiently regular to enable a tight, uniform core to be built. The other feature is the use of mica tape bonded with a modified epoxy resin for insulating the stator coils. This technique has been used abroad but has not so far been applied in this country to such large machines. It is particularly useful for such applications as pumped storage plant, where its ability to withstand differential expansion consequent upon frequent starting-up and shutting-down is of importance.

The AEI machines will be started by an a.c. pony motor for pump operation. The pony motor, mounted on the main machine shaft, will enable starting currents to be restricted to less than one-quarter the full load current of the main machines, thereby avoiding one of the main difficulties of large pumped storage plant, the large voltage drops on starting associated with long supply lines. The machine rotors will be built up from thin steel segments to facilitate erection on site. This is said to be the first time that such a construction has been used for large hydro-electric machines operating at 500 r.p.m. It is also the first time that such a high speed has been used for hydro-electric units with outputs in the region of 100 MW.

The English Electric equipment comprises two 142,000/136,500 h.p. reversible pump/turbines and two 111 MVA motor/generator units. The turbines will be of the vertical Francis type and the motor/generator units will be rated 100 MW at 0·9 p.f., 16 kV, three-phase. The units will be mainly constructed at the Scotstoun works of Harland and Wolff, together with governors and 80 ton valves. Development work on the reversible pump/turbine units has been carried out at the company's hydro-electric division at Netherton and Rugby.

The Cruachan scheme will be the first installation where single-stage reversible pump/turbine units have been used for a head exceeding 1,000 ft. The only comparable plant in Great Britain is the Blaenau Ffestiniog pumped storage station now under construction in North Wales and intended to operate in conjunction with the Trawsfynydd nuclear station. However, the units at Ffestiniog are only rated 75 MW and they have separate pump and turbine units, permitting the rotation when generating and motoring to be in the same direction.

Power House Construction

To house the hydro-electric plant, an underground power house, 350 ft long with an arched roof 120 ft above lowest floor level, is to be formed inside the granite mountain. The contract for the power station has been awarded to Edmund Nuttal, Sons and Co. and work is expected to start shortly. The station will be connected to Loch Awe through a tunnel 3,200 ft long and 23 ft diameter. Linking the station with the storage dam will be two inclined shafts, 1,700 ft long and 15 ft diameter. Accommodation will also be provided underground for switchgear and high-voltage transformers. These will be connected to a surface switching station near the dam site through combined ventilating and cable shafts. The electrical and mechanical consultants for the Loch Awe scheme are Messrs Merz and McLellan, and the civil engineering consultants are James Williamson and Partners.

STANDARDISATION PROGRESS

BRITISH STANDARDS . . . INTERNATIONAL RECOMMENDATIONS . . . INDUSTRY CODES

PLANS agreed at a meeting of CEE, the International Commission on Rules for the Approval of Electrical Equipment, held in the early summer, include a new European scheme for mutual recognition of test certificates. Under the scheme, which replaces an existing reciprocal licensing scheme, samples of equipment need to be tested in official laboratories of two countries.

Tests in three countries were necessary under the old scheme which, although in existence for several years, had never been used by any manufacturer. The scheme applies to equipment made in any country, although the criterion for approval will be confirmation with the appropriate CEE specification.

Among less welcome results of the meeting was confirmation of the UK as odd man out amongst the 15 member countries of CEE, so far as rubber-insulated cables and flexible cords are concerned. All other members agreed to adopt a revised specification, which gives metric dimensions only, within a year of its publication, expected next November. A move to agreement on conflicting European standards for rubber-insulated cables was a question to which CEE agreed to give priority following talks last year between the standards organisations of European Common Market and European Free Trade Association countries.

CEE has been considering a French proposal that specifications covering quality as well as safety and satisfactory operation should be prepared. On this question there was support from a number of countries for a UK proposal that methods of test for measuring quality or performance might be included in CEE specifications, but that actual levels of quality of performance should not be specified.

Amongst several detailed matters dealt with was a suggestion, generally agreed to, that the outside diameters for p.v.c. conduits and fittings should be the same as those standardised for steel conduit. It was provisionally agreed to specify one grade of such conduit, with a wall thickness about equal to the light type included in the relevant draft British Standard.

NEW B.S.I. WORK

CHANGES in the widely used BS 1320 on 11 kV o.h. wood pole lines are expected as the result of a revision now in hand. However, BSI state that no major change is expected in the standard. Background to the revision is the accumulation of operating experience, including improved constructional methods and the availability of new materials. Another standards' project of interest to the electrical industry is the revision of BS G148 which deals with platinum wire thermometer bulbs and connectors for aircraft. Provision is to be made for bulbs suitable for use at temperatures of about 180°C.

Standard Symbols

STANDARDISATION of symbols and their method of use could avoid much difficulty for engineers studying technical literature. BS 1991 *Recommendations for Letter Symbols, Signs and Abbreviations* attempts this, and it has recently been extended by publication of four parts, including two of particular interest to electrical engineers: part 2, which includes nuclear engineering, and part 5, applied thermodynamics.

Not only does the standard list the recommended symbols for particular quantities, it also lays down principles for consistent use of abbreviations which cover such matters as ways of setting down a range of values, and unambiguous statement of quantities such as W/cm deg C, which occurs in thermal conductivity considerations. Amongst the general notes in the standards is a dismissal of "Centrigrade" as a name for the temperature scale, the term "Celsius" being preferred.

THERMOCOUPLE DATA

TABLES of electromotive force against temperature for copper/constantan thermocouples are set out in BS 1828:1961. The tabulation has proved necessary because it has been impossible for British wire manufacturers to produce copper-nickel alloy in bulk which will give values in accordance with available US tables.

Lighting for Runways

IN hand by BSI at present is a comprehensive series of standards for lighting fittings for civil land aerodromes. Three standards published recently are part of this BS 3224, section D, *Runway Lighting*. The three are D2, omni-directional elevated runway lighting fittings; D6, high-intensity elevated runway-threshold lighting fittings; and D7, omni-directional elevated runway-threshold lighting fittings.

It is a feature of this series of standards that constructional details are not dealt with. Instead, it is the performance and essential electrical features, excluding lamps, that receive attention. Light distribution is closely defined, and attention is given to such matters as resistance of ingress of water and resistance of glass components of the fittings to thermal shock.

CABLE INSULATION

THREE recently published standards deal with insulation for electric cables. One of them, BS 3387:1961, *Butyl Rubber-Insulated Cables and Cords with Heat-resisting Fibre Layer*, covers a construction suitable for use where the combination of ambient temperature and temperature rise on load results in a continuous conductor temperature as high as 100°C.

Cables and cords dealt with in the standard are 250/440 V and 660/1,100 V cables and flexible cables, single core, asbestos-braided and painted, and 250/440 V flexible cords with up to three conductors, either braided with a suitable textile material, or asbestos-braided and painted. Typical suitable textile materials are acetylated cotton and polyethylene terephthalate yarn (Terylene). The standard specifies thickness of insulation and general constructional features, and defines the tests that should be applied.

The other two standards are both parts of BS 2899, *Rubber Insulation and Sheath of Electric Cables*. They are part 2, silicone rubber insulation, and part 3, butyl rubber insulation and sheath. The previously published part of the standard, which now becomes part 1, deals with natural rubber insulation.

In the case of part 2, the standard is mainly concerned with tests, and attention is given to conditioning of samples for this purpose. Values are set for tensile strength, elongation at break, tension set, volume resistivity and for characteristics after accelerated ageing.

Part 3 covers somewhat the same ground, but additional requirements are included for characteristics after heat ageing, for power factor and permittivity and for water absorption. Because experience with butyl rubber-insulated cables is relatively limited, it is intended to re-examine the requirements of this standard rather earlier than is usual for revision of a BS.

new products and appliances

Ultra enter domestic heater field

ENTERING the rapidly growing market for tangential fan heaters with their first venture in the domestic heater field are Ultra Radio and Television. This model, designated "Heatwave," has two-heat control, 2 kW full heat and ½ kW low heat. It can also circulate cold air at high and low speeds. A thermostatic control is infinitely variable between 50°F and 86°F and a pilot light is fitted as an indicator of the control position. Weighing 9½ lb, the "Heatwave" has an adjustable chromium plated stand which can also be utilised as a carrying handle. Suitable for a.c. voltages only, it is 4¼ in. high, 12¼ in. wide and 6¼ in. deep. The cabinet is finished in stove enamelled pale grey with white and charcoal facia. Selling price is fixed at £11 19s 6d, including purchase tax. *Ultra Radio and Television Ltd., Eastcote, Ruislip, Middx.*

Dryer has tumble action

AMONG the recent advances in home laundry equipment is the advent of the tumble action clothes dryer. One of the first in this field were Burco, who this week launch a new model, "Tumblair De Luxe" D3, which has been developed from its predecessor, model D2, and has among its features three-heat control and a final cooling cycle. In common with its forerunner, this unit tumbles wet clothes in a stream of heated air circulated by fan. There are two controls, one to obtain maximum loading of 2·5 kW decreasing through 1·25 kW and 625 W to cool air only, and the other to operate the timer graduated in ten-minute intervals. An advantage of this model is the cooling cycle, whereby the drum continues revolving without heat for five minutes beyond selected time, enabling both drum and clothes to cool. A drop-front door assists loading of the drum, which has a maximum capacity of 6 lb cotton and 4½ lb nylon. The perforated drum is illuminated when the door is open. Standard model has a frontal exhaust vent, but another model, D3R, is available with exhaust vent at the back, with a short vent pipe supplied for fitting through a wall.

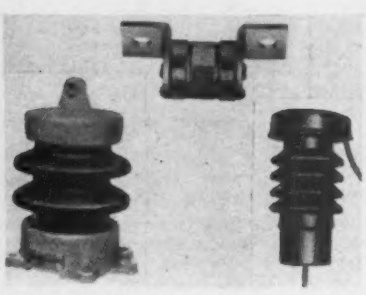
Rubber castors are fitted as standard accessories on these units, which are 36 in. high, 21¼ in. wide by 21 in. deep. Finishes are in white and blue and cream and blue. The price of £56 10s 2d includes purchase tax. *Burco Ltd., Burnley, Lancs.*

Tumble action is a feature of Burco's new dryer

Protection for semiconductor power rectifiers

ALTHOUGH silicon and germanium rectifiers possess well-established advantages in power applications, they suffer from the drawback of being particularly susceptible to damage due to momentary current overloads and inverse voltage transients. To provide adequate protection for these devices, a range of special h.r.c. fuse-links and surge-diverters has been developed. The fuse-links are designed to have melting time/current characteristics to match requirements of individual rectifiers and, at the same time, to give discrimination with associated protective equipment. In addition, fuse elements are shaped to limit transient arc-voltages and so prevent surge damage during fault clearance. Enabling design of a co-ordinated protection system, the fuse-links can be fitted with striker-pin mechanisms which trip appropriate circuit-breakers in the system when the fuses rupture. Fuse types are available for both low- and high-voltage operation.

For surge voltage protection, a range of diverters is available for a.c. or d.c. in voltage ratings from 500 V. Incorporating a series arrangement of spark-gaps and non-linear resistors, these units feature special provision for control of gap-voltage distribution. The diverters are robustly designed to cope with frequency and magnitude of surges normally encountered while d.c. types incorporate a magnetic arc control device to extinguish currents in excess of the designed maximum. *EMP Electric Ltd., Garman Rd, N.17.*



EMP components for semiconductor protection

Price cuts . . .

THE already low price of the Flatley dryer is to be reduced from September by £1, making the retail cost £5 19s 11d.

Lec Refrigeration announce that from 21 Aug. price maintenance control on their domestic models, "Coronet," "Colonial," "International" and "Continental," will be withdrawn. Production of these models is stated to have ceased, but manufacturers say limited stocks can be purchased from the factory at special prices subject to availability.

. . . and increases

Price of the Ever Ready "Arvin D.S. 15" electric razor is to be increased from 1 Sept., when the new retail price will be 64s. This is an increase of 5s 4d on the old price, but makers say retailers will be allowed to purchase stocks at current prices until 31 Aug.

A. J. Flatley Ltd., Salford 6.

Lec Refrigeration Ltd., Bognor Regis.

Ever Ready Razor Products Ltd., Bedford Row, W.C.1.

Storage heater for commercial use

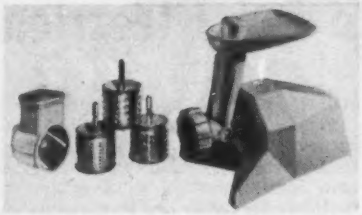
THE advantages and economy of "off-peak" heating are being utilised by Heatstore, who have produced a block-storage heater for commercial use. This is available in five sizes from 1 kW to 3 kW, with intermediate ½ kW ratings, at costs ranging from £12 to £20. These appliances conserve heat in specially designed firebricks, insulated by glass fibre from the metal casing. Heat is stored during nights and slowly dissipated during the day. Units are equipped with synchronous time switches at a further cost of £6 8s 6d, and room thermostats to ensure even temperature control are also available as extras. *Heatstore Ltd., Progress Wks, Brackley, Northants.*

Heatstore's commercial block storage heater

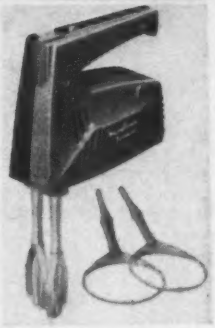
Junior version of Moulinex beater

IN pursuance of the fully electric push-button kitchen, Moulinex have produced a junior version of their beater for which the sole distributors in this country are Andrews Houseware. This beater is designed to take the manual labour from whisking and whipping, two sets of blades being provided for the purpose. These blades are simply pushed into sockets and locked in place; they are ejected by depressing a button. The Junior Beater is constructed of double insulated nylon with blades of the same material. It is loaded to 90 W and driven by an air-cooled motor. Retail price, including purchase tax, is £2 18s.

A redesigned appliance from the same firm is the mincer/grinder, also constructed of double insulated nylon. It has two mincing attachments for raw and cooked meats and three graters and shredders for vegetables and soft foods. In common with the beater, this unit has an air-cooled motor. Finish is available in cream and it retails at £7 17s 6d, including purchase tax. *Andrews Houseware Mfrs Ltd., 137 Kirkdale, Sydenham, S.E.26.*



Above: The re-styled mincer and grater is constructed of double insulated nylon and has an air-cooled motor. Two mincing attachments and three grater/shredders are supplied as standard equipment



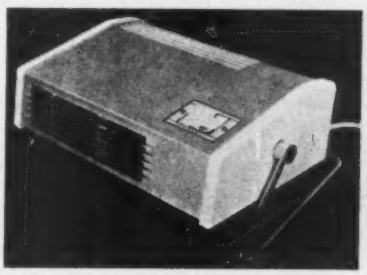
Right. The new Junior Beater goes a stage further in attaining a pushbutton kitchen

Portable battery searchlight

PROVIDING copious illumination for carrying out both emergency and routine operations, a compact searchlight unit available weighs only 13 lb and has dimensions 7½ in. by 5½ in. by 8½ in. Normally fitted with a twin-filament, 3·0/0·5 A bulb, the lamp is powered by a six-cell Nife battery giving 3 hr to 4 hr continuous light using the main filament and 20 hr on the reserve. Alternatively, a 1·0/1·0 A twin filament bulb is supplied which will provide 9 hr to 10 hr of light from a single battery charge. The lamp has a parabolic silvered reflector with adjustable focus, said to give a penetrating light beam with wide-angle diffusion. Other features incorporated are a four-position push-button switch and protective fuse. Designated the "S.6," the lamp holds a Ministy of Fuel and Power certificate of approval for use in gaseous mines. *Nife Batteries, Redditch, Worcs.*

W. German heater

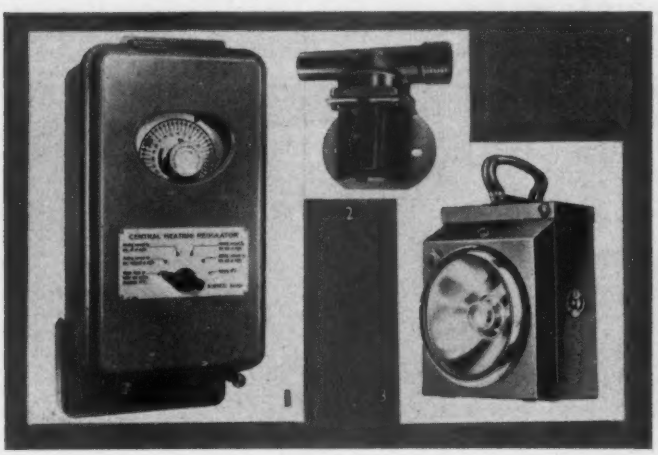
YET another tangential fan heater to come on the market is a model of West German construction imported by G. W. Burger. Called the "Record" turbo-heater it conforms to BSS and has push-button controls. Retailing at 8½ gn including p.t., the heater is loaded to 2 kW



for heating and 1 kW as a fan. Compact in size, 12 in. by 9 in. by 6 in., it is easily portable and has a built-in safety cut-out. Mounted on an adjustable stand, the heater has a metal and plastics casing finished in grey and off-white. It is available ex stock. *George W. Burger Ltd., 63 St. Gabriel's Rd, N.W.2.*

Revised prices

C. E. SLEEPER Ltd., makers of push-button, limit and remote-control switches, announce that new prices become effective from 1 Sept. New lists are available from *C. E. Sleeper Ltd., Ponsford Wks, Minehead, Som.*



1. "Sigma" central heating controller. 2. Solenoid valve by Sumlite Controls designed for use with domestic washing appliances 3. Portable searchlight powered by Nife alkali batteries

Electric control for central heating

A RANGE of controllers available for oil-, gas- or solid-fuelled central heating systems perform dual functions of on/off switching to predetermined weekly programmes and of maintaining constant inside temperatures against variations in outside weather conditions. The latter is achieved by controlling circulating water temperature as a function of heat losses under specified conditions. The basic control circuit employs a Wheatstone bridge arrangement, an outside temperature sensing element comprising one arm of the bridge and a pipe temperature element the other arm. Circulating water temperature is governed by a motor-driven cold/hot water mixing-valve actuated by the control unit in response to the degree of bridge balance due to prevailing temperature differential. Known as the "Sigma" range of controllers, the basic unit incorporates a selector switch giving a range of five different heating programmes, which include night or week-end shut-off, boiler depression, or extended day and night operation. The unit works at standard mains voltage and has provision for adjustment of the control circuit to match heat loss characteristics of individual installations. *Stonebridge Electrical Co. Ltd., 6 Queen Anne's Gate, S.W.1.*

Solenoid valve for appliances

INTER-LAYER winding insulation plus p.v.c. encapsulation are features incorporated in a new solenoid valve to ensure reliable operation even when immersed in water. Designed specifically for use with appliances such as home laundry units and dishwashers, the valve is capable of holding water pressures of 300 lb/sq in. and of operating against pressures of up to 150 lb/sq in. Of the balanced type it makes use of the pressure of the water to do the work of opening and closing, the solenoid serving merely to actuate a small auxiliary valve. Although the coil is wound for 230 V to 250 V, the valve may be actuated at supply voltages as low as 190 V. The valve body is of brass with stainless steel lining and the inlet is fitted with a wire gauze filter. External brackets are heavily plated to combat corrosion, and the fitting is available for mounting with the coil in any plane. *Sumlite Controls Ltd., The Airport, Ponderford, Wolverhampton.*

Materials for Electrical Design

NEW CERAMIC

A NEW ceramic material, combining high purity, near-maximum density and great strength is announced. The material is translucent magnesium oxide which has the unusually high melting point of 2,800°C and, when chemically polished, has a strength of 45,000 lb/sq in., 87% higher than that of ordinary magnesium oxide. According to Dr Larsen, of Honeywell, the density is within 2% of the maximum possible. The new ceramic is particularly suitable for electrical insulation at high temperatures and as a heat exchanging medium. *Honeywell Controls Ltd., Greenford, Middx.*

MORE POLYTHENE REDUCTIONS

FOLLOWING the recent announcement by ICI of reductions in the prices of grades of polythene, a similar announcement has been made by Monsanto. Virgin polythene is down by 3d/lb and certain moulding grades by 4d/lb. *Monsanto Chemicals Ltd., 10-18 Victoria St, London S.W.1.*

RHODIUM PLATING

RHODIUM plating is used by many designers of electrical components for a variety of reasons and purposes. from the flash coatings of low current carrying contacts to the heavier protective coatings where chrome or nickel are unsuitable. A difficulty sometimes encountered is cracking of the finish which has been attributed to a stressed condition of the deposit. A new electrolyte has been developed which permits deposition of heavy coatings with low stress and hardness up to 800 d.p.n. Containers, anodes and general operating procedure are as for conventional plating but, for the best results, additional precautions have to be taken. *Engelhard Industries Ltd., Baker Platinum Div., 52 High Holborn, London W.C.1.*

SILCOSET RUBBER APPROVED

FIVE of the ICI Nobel Division "Silcoset" silicon rubbers, Nos. 100 to 104, have received provisional approval from the Ministry of Aviation for potting and encapsulation of electrical and electronic components. It is understood that the provisional approval will be replaced by full approval when inspection schedules and facilities have been completed. *Imperial Chemical Industries, Imperial Chemical Hse, Millbank, S.W.1.*

'WHISKERS' ON CONTACTS

IT has been found by electrical engineers to their cost, that metal or metal-plated contacts will, in certain circumstances, develop "whiskers"—long hair-thin crystals which can bridge the gap between closely adjusted relay contacts and cause spurious circuit operation. This phenomenon is noticed with cadmium, tin, zinc and some other metal coatings, and it is, of course, an undesirable feature which is becoming an acute embarrassment to designers of electronic equipment on a miniature or sub-miniature scale.

After an initial study of the mechanism by which they develop, as yet not completely explained, the Tin Research Institute has produced a nickel-tin alloy which, after storage for two years to date in "whisker-growing" environments, has not grown them. There is, therefore, hope that this particular hazard may be designed out of future equipment, but it is stressed that the trial period is by no means over and will be continued indefinitely or until whiskers do appear. *Tin Research Institute, Fraser Rd, Greenford, Middx.*

FLUXES FOR CABLES

RESEARCH on fluxes for the tinning of aluminium and copper cables has led to new experimental fluxes being developed by Fry's Metal Foundries Ltd. For aluminium cables, "Kynal Flux" has been used by electricity boards and cable manufacturers and is marketed by Fry's Metal Foundries. A new "Tandem Flux" has recently been developed by Fry's. In fluxing power it is not quite so effective as "Kynal," nevertheless. it gives satisfactory results in use. On the other hand, "Tandem Flux" reduces the fumes by about 20%, which is an advantage. Both fluxes are marketed by Fry's, the choice is left to the individual buyer.

For copper conductors, "Alcho-re" safety resin flux has been used in the past and to a very great extent it has replaced the use of powdered resin, which is not so easy to apply, and which has less fluxing power than "Alcho-re" paste. One of the problems is that the flux is used in a confined space and, because of this, Fry's have experimentally developed "Merton Flux" which, whilst not quite as safe as "Alcho-re," eliminates resin fumes, which some operators dislike. Here again, the choice is left to the individual user, both "Alcho-re" and "Merton Flux" now being available.

Further investigation is being continued to find improved fluxes for aluminium and copper cables and on a much wider range of fluxes for the electrical and engineering industries. *Fry's Metal Foundries Ltd., Tandem Wks, S.W.19.*

Self-propelled Oil-conditioning Plant

PERHAPS the most familiar of transportable oil-conditioning plants to the supply engineer, the "Ilovac" unit has now been extensively modified, improved and housed in a self-propelled articulated vehicle. Designed specifically for on-site changing and reconditioning of transformer and switch oil contents as well as for initial filling with de-aerated "superdry" oil, the equipment includes pumps, oil heaters, centrifuge, vacuum tank and ancillary control apparatus. The centrifuge removes free water and contaminants, and the cleaned oil, emerging as a fine mist, is then subjected to high vacuum to remove the last traces of dissolved water and air.

When being used for initial filling of switch and transformer tanks, the latter should be maintained at a mild vacuum. If transformer windings are shown to have absorbed moisture by resistance check, clean oil at a higher temperature is circulated between the unit and transformer until both insulation resistance and tests of the circulated oil show that the windings are fully dried out.

A close check on proceedings is maintained from the mobile laboratories which usually accompany the "Ilovac" unit in a separate vehicle. Requests for "Ilovac" service should be addressed to the Electrical Div., Castrol Industrial Ltd., Marylebone Rd, N.W.1.

The re-designed Castrol "Ilovac" unit on its self-propelled articulated chassis

News of the Week

1,200 MW Station for E. Lothian

Consent for 244-acre site at Cockenzie sought

CONSENT for the construction of a 1,200 MW coal-fired power station in East Lothian, on the Firth of Forth, is being sought by the South of Scotland Electricity Board. Application for approval has just been made to the Secretary of State for Scotland and, if granted, the Board hope to begin work on the site early next year. A 244-acre site, immediately to the west of the village of Cockenzie, some ten miles east of Edinburgh, has been selected out of 19 possible sites considered by the Board.

The generating station—the main part of the constructional work—will occupy a seashore site of 800 ft by 425 ft, and will involve the reclamation of an area below the high-water mark. It is proposed to take in, on the landward side, about 200 acres for railway yards and coal dumps. There are to be two 500 ft high brick chimneys. The station will require about 10,000 tons of coal/day, and two shafts, Monktonhill and Bilston Glen, are conveniently placed to supply fuel to the site. Coal will be delivered by rail to marshalling yards near the Edinburgh-North Berwick coast road, and fed to a system of conveyor belts.

It is planned to install four 300 MW turbo-generators in the station.

Any official objections to the proposals must be lodged with the Secretary of State by 3 Sept., but it is considered unlikely that any objections will be made, as the project has been under joint investigation by the Board, the East Lothian County Council and local burgh councils for several years.

A.G.R. Containment Building Tested

COMPLETE enclosure of radioactive equipment within a 135 ft dia structure is a feature of the advanced gas-cooled reactor, now nearing completion at Windscale. Over the Bank Holiday week-end, this containment building was tested at an air pressure of 12½ lb/sq in. gauge. The UKAEA report "very satisfactory results" from this test and from a sub-atmospheric test. They say these results reflect credit on the standard of work of Babcock and Wilcox, who constructed the building, and Lloyd's Register of Shipping, who surveyed the work, as well as the authority's own construction organisation.

A.E.I. Factory for Sale

THE Tottenham factory of AEI has been placed on the market. Price asked is £675,000 for the modern property, which has a floor area of 160,000 sq ft. This is the factory which AEI announced would close down as a result of AEI (Woolwich) withdrawing from the transistor and semiconductor field. Other operations are being transferred to Brimsdown.

Dundee Expansion Planned

EXTENSION of the Carolina Port, Dundee, steam power station is planned by the North of Scotland Hydro-Electric Board. The latter propose to install one 120 MW machine with an oil-fired boiler. Planning permission is now being sought from the local authority for the additional land needed. The existing Dundee station has two 30 MW and one 15·625 MW machines installed.

SINGER ENTER 'FRIDGE MARKET

SINGER Sewing Machine Co. Ltd. are widening their activities to encompass the domestic refrigerator market. They have launched two models which are being sold through their own shops.

In this capacity the company are acting as distributors, as the units are made for them by another British firm. The two models, a 4·6 cu ft unit, F.40, retails at 49½ gn, and a larger 6·6 cu ft model, F.60, sells at 69 gn. Singer, who already sell vacuum cleaners and irons, plan to enter other appliance fields in the near future. Washing machines, spin dryers and space heaters are believed to be included in this attack on the market.

Transistor Deals

RATIONALISATION in the transistor industry is proceeding apace. Associated Transistors, which operates a factory at Ruislip, has been bought by Mullard's for around £700,000. Mullard's will integrate this plant with their own Ruislip factory, but retain the 350 employees involved. Associated Transistors was formed in 1958 by ATE, EE and Ericsson jointly.

Another new move is the purchase by Plessey of Philco Corp. of Philadelphia's minority interest in Semiconductors Ltd., Swindon. By this transaction Semiconductors becomes a wholly owned subsidiary of Plessey, but retains non-exclusive manufacturing rights of Philco transistors.

Increased Analyser Charges

INCREASED charges are announced by the ERA for the use of its network analyser. As from 1 Oct. next, members will be charged £45 for a day's use of the analyser where problems of a routine nature are concerned. This charge includes provision of operating staff and a report of the results. The corresponding charge for organisations which are not members of the ERA is £60/day's occupation.

Dishwasher for Australia

COLSTON have taken the initiative in the potentially large market for dishwashers in Australia. The first shipment of English-made models left this week, and plans are already being made for local assembly from imported components, with the gradual introduction of Australian-made parts until the dishwasher is manufactured completely in Australia. Distribution will be in the hands of Pye Industries Ltd., an associate of Pye, of Cambridge, which owns Bendix Tecnico (Australia).

Nuclear Fuel Loading Begins

LOADING the uranium fuel elements into the first reactor at Berkeley nuclear power station was begun last week-end by the CEGB. Loading at Bradwell also began at the beginning of this week. These two stations will be the first commercial nuclear power stations in Britain to become operational. The reactor at Berkeley is expected to go critical before the end of this month and, after exhaustive testing, commercial production of power is anticipated by the end of the year. Both Berkeley and Bradwell nuclear stations are being built by The Nuclear Power Group. Berkeley has two graphite moderated reactors with an eventual output of 275 MW. The Bradwell station also has two reactors with a designed output of 300 MW. Site work began at both stations in January, 1957, and they are both scheduled to be fully operational by late in 1962. With these two nuclear stations well on the way to completion, The Nuclear Power Group are now submitting their tender for the 550 MW station at Oldbury. A feature of this tender is enclosure of the two reactors in pre-stressed concrete, instead of steel, pressure vessels, allowing of a cheaper design.

Inside the soundproof control room of BOAC's new Component Test House at London Airport, a technician adjusts an oscilloscope which permits close investigation of patterns selected for detailed examination. This room is high above the electrical test cell. The equipment shown was supplied by Telequipment Ltd., London

Clydesdale Creditors Reject Offer

UNSECURED creditors of Clydesdale Supply Co. have rejected an offer of 5s in the £1 from Craibstone Investments Ltd., of Aberdeen, at least for the time being. A meeting in Glasgow last week was told that a statement of affairs of Clydesdale, Scottish radio, TV and furniture chain, showed a deficit of £2,139,000 at 1 July. The chairman of the creditors' investigating committee, Mr W. J. M. Galbraith, chartered accountant, recommended acceptance of the Craibstone offer, but the principal trade creditors, with claims amounting to £1¼ million, held out. They considered that some assets were undervalued, particularly leasehold and freehold properties.

There had been an alternative proposal from a London business man, Mr Kenneth Littner, for reorganising Clydesdale, but the investigating committee had found that any proposals for the continuation of the company would depend upon the support of hire-purchase companies, and this would not be forthcoming. Inviting higher offers, the meeting adjourned until 21 Aug. to reconsider the position.

OFFICIAL PUBLICATIONS

Scholarships and Other Awards Available to British Students for Training in Electrical and Allied Engineering. BEAMA, 4s (see page 241).

Code of Practice for the Display of Sources of Ionizing Radiations at Exhibitions. HMSO, 6d.

Mines and Quarries Form No. 267 (Mines of Coal, Stratified Ironstone, Shale or Fireclay). Mines and Quarries Act, 1954. Coal and Other Mines (Mechanics and Electricians) Regulations, 1956, etc. HMSO, 3s.

House Insulation. Simple Aids to Warmer Homes, revised 1961. HMSO, 4d each, up to £5/1,000.

Dept. of Technical Co-operation Order, 1961. Ministers of the Crown (Transfers of Functions) Act, 1946, s.l. HMSO, 3d.

BS 3398. Anti-Static Rubber Flooring. 4s.

BS CP 1011. Maintenance of Electric Motor Control Gear. 6s (see page 229).

BS amendments:
7, Rubber-insulated Cables and Flexible Cords for Electric Power and Lighting (for Working Voltages up to and including 11 kV), PD 4197; 697, Rubber Gloves for Electrical Purposes, PD 4182; 903, Methods of Testing Vulcanised Rubber, Part D; 4, Determination of Cross-breaking Strength of Ebonite, PD 4192.

Report on the Census of Production for 1958. Part 61, miscellaneous electrical goods. HMSO, 2s (see page 241).

BEAMA Statistical Review of Domestic Electrical Appliances (subscribers only).

REFRIGERATOR SALES LAG BEHIND

REFRIGERATOR sales picked up slightly in June, but still lagged badly behind most other appliances. In that month, the home market took 117,805 refrigerators from manufacturers, which was 7% less than a year earlier against a shortfall of 12% in May. Exports show a similar pattern, with June's total of 12,626 refrigerators representing a 14·5% decline on June last year, whereas the gap in May was 20%. Things have not improved much in the past few weeks, judging by the reports of retrenchments which are coming in comparatively early in the year. Electrolux have decided to put off 240 of the 1,850 workers at their Luton factory at the end of this month, Ranco Ltd. have just dismissed 400 workers from their factory in Lanarkshire which makes temperature controls for refrigerators, and AEI's cuts are now taking effect.

By contrast, appliance trading in general was 5% above the level of the previous June. This was a good performance by comparison with overall retail trade, which eased a fraction in June and was only about 2½% higher than a year ago. It is too early to say how appliances have fared since the "little Budget" but they are believed to have done well in the last-minute rush to beat the extra purchase tax. Retail trading as a whole was 5% higher in July than a year earlier, according to BoT preliminary estimates.

Immersion heaters recover

AFTER a lapse last month, sales of new immersion heaters by area boards for June have shown an increase, although they are 13·9% below the corresponding period last year. Water storage heaters have also shown a slight increase over the preceding month.

Manufacturers are still having considerable success with the new designs in washing machines and sales by area boards are 25·9% above that of a year ago. Sales of refrigerators are lagging, but on the other hand new cookers have risen 13·8% over last year.

Appliance sales by Area Boards	Sales in month ended 30 June, 1961		Sales in 12 months ended 30 June, 1961	
	Total	% change over corresponding period of 1960	Total	% change over previous 12 months
Cookers ...	29,125	+13·8	346,328	+ 1·8
Water Heaters:				
Immersion...	26,637	−13·9	193,397	− 0·2
Storage ...	5,391	− 0·6	63,661	− 3·9
Washboilers	4,395	− 2·1	54,391	−12·3
Washing Machines	8,562	+25·9	100,174	−31·1
Refrigerators	21,653	−27·4	125,341	−25·4
Clothes Dryers	1,229	+30·1	55,360	not avail.

Zone Lighting for Birmingham

RESTRICTION on lighting display has been introduced by Birmingham Corporation, who have split the city centre into three zones. They intend to have a "bright lights" quarter, a "dignified civic centre area," and a "commercial" zone. Prospective developers will have to conform to the new zoning plan for illuminations and watch will be kept on colour schemes to ensure harmony at night. The Bull Ring, in the heart of the bright quarter, is expected to become a blaze of colour under the new scheme. Adjoining this will be the civic centre and cathedral area, where floodlighting is expected to take precedence and, in the third zone, illumination of buildings by neon lighting will be permissible, but not to the extent of the shopping area.

Lydd-Bolney Line

THE CEGB have now made formal application to the Minister of Power for consent for the erection of a 400 kV overhead transmission line between Lydd and a proposed substation near Bolney, Sussex. They seek consent for one of two alternative routes or any combination thereof. Proposed routes of the line were reported in our 13 July issue.

Pay Claim in Engineering

AN immediate claim for a "substantial increase" in the salaries of its 20,000 members in the engineering industry is to be made by the Association of Supervisory Staffs, Executives and Technicians. A claim on behalf of manual workers in the engineering industry has already been lodged by the unions.

MAJOR TELEPHONE SHAKE-UP

Plessey, A.T.E. and Ericsson Propose Huge Merger

AT least two months must elapse before it will be known whether the proposal to merge Plessey, Automatic Telephone and Electric and Ericsson Telephones will reach fruition. The three boards expect the formal documents to be submitted to their shareholders in about six weeks' time, now that rumours have been forestalled by an early announcement. But the terms having been carefully negotiated so as to be, in City opinion, fair to everyone, it looks as if another giant will be born.

If the proposals succeed, the new group will handle a large slice of the GPO's telephone work, perhaps 40%, and exports to the less highly developed countries would also be considerable. The combined equity would be worth around £75 million, assets over £45 million, and annual earnings in the region of £10 million. Main competitors, as far as telephone work in this country is concerned, would be STC, AEI, GEC and Pye, though not necessarily in that order.

The form of merger proposed is for Plessey to acquire the other two companies for shares, cash and convertible loan stock at prices worth about 18s for each ATE Ordinary share and 32s for Ericsson. Preference shares of both companies would be bought for cash. Plessey already own 140,000 Ordinary 5s shares in ATE and 895,000 5s Ordinaries in Ericsson, but this is only a small proportion of the capitals involved.

More significant is the strong recommendation from the three boards that the terms be accepted. The directors of all three companies are confident that the proposed merger is soundly based and calculated to safeguard the interests of all shareholders and employees alike.

The three companies are members of the consortium of seven telephone manufacturers which tried unsuccessfully last year to prevent Pye from obtaining control of the Telephone Manufacturing Co. and so entering the British telephone supply field. Apparently, that kind of association proved too nebulous to provide the rationalisation benefits which could be expected from the merger.

New Ekco Export Co.

A NEW subsidiary company, Ekco Export Ltd., has been formed by E. K. Cole Ltd., to handle the export of radio, TV and car radio receivers, electric heating and plastics products manufactured by the Ekco group. The company will also be responsible for maintaining and expanding overseas manufacturing arrangements. Director and general manager is Mr T. C. Cleveland, and other directors are noted on page 233. The concern will operate from the Southend-on-Sea works, and a Personal Exports Depot and showroom for radio and TV receivers will be opened at 41-47 Old Street, E.C.1. Ekco's previous Export Sales Dept. at 5 Vigo Street, W.1, has been transferred to Southend.

E-A form new dept.

AN automation analysis department within its data processing group of divisions has been formed by Elliott Bros. Ltd., a member of the Elliott-Automation group. This department has been formed to undertake specialised studies in the true mathematical nature of industrial processes.

Housecraft by Correspondence

THE Electrical Association for Women are now offering a 20-lesson correspondence course in electrical housecraft for those unable to attend instructional classes. The first correspondence course will begin this month and will be completed in time for next December's examination for the EAW certificate. Fee for the course is £6 10s.

It has also been decided to change the name of the certificate. Hitherto entitled the EAW Home Workers' Certificate, the award will now be called the EAW Home Electricity Certificate.

TECHNICAL WRITING COURSE

BOROUGH Polytechnic, London S.E.1, have arranged a day-time course of six lectures on *The Technique of Technical Writing*. The course is intended for graduates and is not suitable for those without experience in technical writing. A panel of experts will conduct the lectures, which will deal with style, sources of information, illustration, liaison with the printer and publishing. The lectures will be held on Friday afternoons, beginning at 2.30 p.m. on 20 Oct., and the fee for the course is 10s. Judging by the number and size of advertisements for technical writers, the course is timely.

On the same brochure, the school advertises a ten-lecture course on *Effective Speaking*, which will be held on Monday evenings at 7 p.m., starting on 9 Oct. The fee, £1.

Scholarships in Electrical Engineering

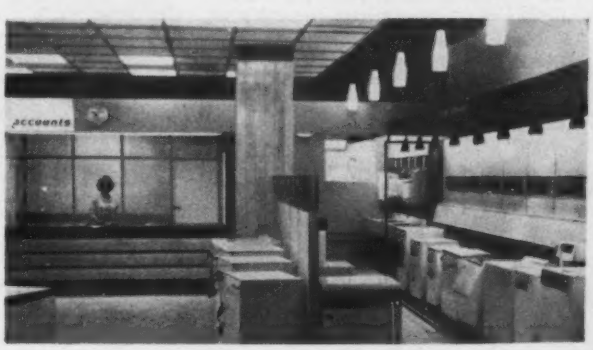
BEAMA have this week issued a revised edition of their booklet *Scholarships and other Awards available to British Students for training in Electrical and Allied Engineering*. The aim has been to include all open scholarships for study in electrical engineering and to list as many as possible of the general awards which are not restricted as to subject and may be used for electrical engineering. However, the booklet does not claim to be exhaustive, especially with regard to awards confined to students from a particular area and not specifically for electrical study. Copies are available from BEAMA Information Services, 36 Kingsway, W.C.2, price 4s.

SUNBEAM PLAN NEW PRODUCT

SUNBEAM Electric Ltd. expect to begin producing an entirely new product at their East Kilbride factory, near Glasgow, within a few months. The exact nature of the product is still a closely guarded secret, but—when he flew into Glasgow a few days ago—Mr R. P. Gwinn, president of the American parent company, said: "It is a small domestic appliance unlike our other products." An idea of the scope of the project is given by two other statements he made. About 300 new jobs will be created at East Kilbride, and Scotland was chosen in preference to a country in Western Europe because it was considered unnecessary to duplicate existing facilities. The present Sunbeam range comprises electric shavers, food mixers, drink blenders, automatic cooking pans, and irons.

1958 Production Report

PRODUCTION of miscellaneous electrical goods in the year 1958 are covered in the latest Census Report published on Tuesday by H.M.S.O., price 2s. Items dealt with include lamps, fluorescent tubes, accessories, lighting fittings, torch cases, batteries, accumulators and electrical equipment for vehicles. Total production value in 1958 amounted to £189,413,000 compared with £149,704,000 in 1954. Details will be given next week.



SWEB's service centre at Weston-super-Mare re-opened recently after remodelling. This picture shows a section of the main showroom. Floor-warming has been installed and there is a special section with seven types of water heaters fitted.

Electrical Company Turns Public

THIS week has seen the first listing on the London Stock Exchange of Carbon Electric Holdings Ltd., newly formed to acquire the whole of the capital of two south coast electrical manufacturers and give them public status. Both created since the war, the two operating companies have become well established in their own fields. The larger is MB Metals Ltd. which, at freehold premises near Brighton, makes plugs, sockets, connectors and switches, over half of the order book consisting of advanced work in this field for aircraft and missile makers and for the CEGB's nuclear reactors. The other operating company is Nobrac Carbon Ltd., which makes carbon blocks for machining into rotating brushes and also produces seals and bearings for shafts. Coinciding with the listing, there is an issue of £100,000 in Ordinary 1s shares, and a like amount in "A" 1s shares. One half of the Ordinary capital is being placed at 2s 6d a share through brokers Arthur Aman and Co., and it is understood that of this number some 300,000 shares are being made available in the market at 2s 7½d each. The "A" Ordinary shares have the unusual trait of not ranking for dividend, but they are convertible into Ordinary shares once profits exceed the 1960 level by 58%. Mr M. J. Lanham, who has been chairman and managing director of both MB Metals and Nobrac since foundation, has entered a service agreement with Carbon Electric. These factors tend to minimise a speculative element suggested by MB Metals' 1960 profit being more than four times the 1959 level, and that of Nobrac more than double. Directors forecast earnings of not less than £76,000 in 1961 (£75,739 in 1960) against capital of £200,000 equally divided between Ordinary and "A" shares, and dividend is expected to be 10%.

New connection terms in N.E. considered

LOCAL authorities in the North East are considering revised terms drawn up by the North Eastern EB for supplying electricity to new housing estates. Under the proposals, the Board will bear the cost of the high voltage system up to the substation on the various housing estates; and the cost up to £45/house in respect of the low voltage distribution system. This represents an average figure which has been worked out by the Board following an analysis of about 50 estates of 10,000 houses. Developers will be expected to bear any cost in excess of this amount. Technical officers of the various local authorities are to report further on the new terms.

Lower Bank Rate for Exporters possible

WORRIED about the effect of the 7% Bank Rate on export competitiveness, the Government is investigating the possibility of a cheaper rate for exporters only. The Bank of England, it is believed, is not convinced that a two-tier Bank Rate is the right solution, and it is presumably from this source that any difference between normal rates and any special rate to exporters would have to be recouped. Even before last month's "Little Budget," however, Britain's money rates were higher than those of the US and most continental competitors. Since then a number of important contracts have already been lost, which is not surprising when West German exporters already have access to cheaper money than their country's standard rate.

How to Invoice P.T. Surcharge

THE Customs and Excise Dept. are allowing alternate methods for showing the Chancellor's 10% purchase-tax surcharge when invoicing goods within the trade. For the convenience of firms with mechanised accounting systems, purchase tax may be shown at the new effective rate against each item, without distinguishing the surcharge, provided the fact that the surcharge is incorporated is indicated somewhere on the invoice. Alternatively, the basic purchase tax only may be shown against each item, and the 10% surcharge calculated on the sum of these amounts and added on at the bottom of the purchase-tax column.

LIGHT FOR PRECISION ENGINEERING

H. M. HOBSON Ltd. did not do things by halves when they decided to improve the lighting at their works in Wolverhampton. Not only did they replace the lights throughout the plant but, following the advice of the Philips lighting design team, also repainted much of the interior to provide reflecting surfaces and a pleasant effect.

To begin with, the illumination level in the main workshop was stepped up from about 12 lumens/sq ft, excluding the extensive supplementary lighting that was necessary, to between 20 lumens/sq ft and 25 lumens/sq ft. This was achieved by replacing the standard pattern of 200 W tungsten lamps with 125 W colour-corrected mercury lamps. Elsewhere, where the roof is higher and the lamps are mounted 40 ft above the floor, 400 W mercury lamps were used.

In the offices, which previously had an industrial type of lighting, tubular fluorescent lamps were fitted to give an illumination of nearly 50 lumens/sq ft.

Hobsons make equipment for the aircraft, guided missile and nuclear industries and were responsible for the design and manufacture of the Berkeley high-activity laboratory for the CEGB. Realising that working conditions play an important part in efficiency, the management made every effort to provide the best surfaces. These range from the natural finish of the Briggs aluminium "Bitumetal" roofing to the white paint used on the structure and the special composition floor with its high reflection factor. The interiors now demonstrate the effectiveness of white and grey, rather than cream and beige, with high-efficiency lamps which are, by their nature, rich in yellow.

To complete the installation, the long frontage of the factory has been floodlit, also by Philips. More than 50 150 W pressed-glass floodlamps are installed at ground level about 12 ft from the façade, and the company name is picked out by groups of four 24 V 150 W Attralux lamps in Wisbech fittings.

Left: Slotted reflector fittings for twin 5 ft fluorescent lamps have been chosen for this part of the factory, providing a good example of a modern industrial installation

Electricity load has been lowered and illumination doubled in this workshop by replacing 200 W tungsten lamps with the 125 W mercury lamps shown here

HAXELL FACTION PREPARES PAMPHLET

A PAMPHLET protesting the innocence of Mr Frank Haxell and other pro-Communist ETU leaders convicted of ballot-rigging will be sent to each of the union's quarter of a million members before the elections for a new executive begin next month. This is the Communist-controlled executive's answer to the threats of disaffiliation from the Labour Party and expulsion of the ETU. The pamphlet, which may run to four or five pages, will be paid for out of union funds and this has aroused voluble, but ineffective, protests from the anti-Communists. At the beginning of this month the executive lodged an appeal against the High Court's ballot-rigging verdict. Another lawsuit is also on the horizon; last year's election of Mr George Scott, national officer at headquarters, is being challenged by his opponent, Mr E. W. Clayton, of Ipswich.

Banned export list shorter

A NEW list of goods which cannot be exported to Russia, China or the Soviet bloc countries has been published by the Board of Trade and supersedes that of February, 1960. It contains 165 items and is said to be shorter than previous embargo lists. The new list also takes into account amendments issued in May this year and is issued for the general information of exporters, but does not itself have the force of law.

In the electrical field three items are listed; electric vacuum furnaces in the following four sub-sections: consumable electrode vacuum arc furnaces with a capacity not in excess of 5 tons; skull-type vacuum arc furnaces; electron beam vacuum furnaces; and cold crucible vacuum induction furnaces designed to operate at pressures lower than 0·1 mm of mercury. Also on the list are diesel engines, 50 h.p. and over, whose non-magnetic content exceeds 50% of their total weight, and electric power generating mobile units of over 5 MW.

Sayings OF THE WEEK

"A constant stream of electricians is leaving Ireland every week, attracted by the higher rates and better working conditions in Britain. We are losing the cream of our skilled craftsmen." . . . MR A. P. TUKE, secretary of the Engineering, Industrial and Electrical Trades' Union, Ireland.

"Administration is in reality an endless belt which knows no endings, happy or otherwise." . . . *The Times* leader.

"The CEGB is now extremely conscious of its responsibility concerning 'wirescapes' and is taking expert advice in remedying some of the mistakes of the past. One should hope that other authorities will do the same." . . . MR R. MILLER, of Crawley, in a letter to the *West Sussex Gazette*.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, August 15

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	230½	−1
,, (3 months)	233½	−1
LEAD, refined pig, 99·97% purity (cash)	64½	−⅜
,, (3 months)	66½	+⅛
TIN, refined, min. 99·75% purity (settlement)	942	+18
(3 months)	952	+16
ALUMINIUM, ingots 99·99·5% ...	186	—
,, wire bars (4×4×54")	193½	—
BRASS Strip 63/37	198½	—
SILVER (Troy oz)	79½d	−½d
ZINC, virgin, min. 98% purity (cash)	76½	−⅜
,, (3 months)	77⅝	−⅜
RUBBER, per lb		
No. 1, RSS, spot	25d	+⅛d
c.i.f. basis, ports, Oct. ...	25⅛d	+⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	69	—
Mild Steel Tape (0·04 in.) ...	53½*	—
NICKEL (home)	660	—
MERCURY (76 lb flask)	63	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	31c	—
Lead (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

TROSSACHS LINE INQUIRY

THE plan of the North of Scotland Hydro-Electric Board to erect a 400 kV transmission line from the Cruachan power station of the Loch Awe project to the grid system at Windyhill, near Milngavie, is to be the subject of a public inquiry at Aberfoyle on 21 Sept. The main objector to the plan is Col A. V. C. Douglas, who has ewes on 3,000 acres of hilly land at Ledard, about 1½ miles of which is affected by the Board's plan. He considers that the line crossing the road at Dubh Lochan will spoil the amenities, and has suggested an alternative route which would add 1½ miles to the line and take it through Glen Dubh.

The Board maintain that this alternative would add £36,000 to the cost and consider that their own route would detract less from the scenic beauty of the area than any other which could be chosen.

Glasgow Corporation have also objected to the scheme and are to be represented at the inquiry.

LARGE CONTRACTS

THE CEGB have awarded a contract to William Boby and Co., water treatment engineers of Hertfordshire, for the installation of a fully automatic demineralisation plant at Bankside.

SERVOMEX Controls has received a £5,000 order for 39 voltage stabilisers for Helsinki University's Institute of Physics. It has also received an order for four infra-red liquid analysers from Sicedison of Italy.

GEC are to supply a 240-speech channel radio link for Cable and Wireless between the Jamaican terminal of the US-Jamaica submarine cable and Kingston Central Telegraph Office.

BRITISH European Airways are following in the lead of BOAC and Swedish Airlines in adopting STC's push-button electronic airline seat reservation system. The new order, worth £2½ million, will be carried out at STC's Newport factory.

KATANGA RAIL ELECTRIFICATION

THE Katanga railway company, BCK, plans to electrify nearly 100 miles of track on the Lobito route between Kolwezi and Mutshatsha. Work on the project began in May this year and the planned commissioning date is November 1962. Five miles of the section were electrified previously to link Kolwezi to Metalkat.

News in Brief

Forty Russian scientists visited South Wales Switchgear's factory at Blackwood, Mon., this month to see equipment under construction for Iron Curtain countries. The party is on a visit to the UK from the Academy of Sciences, Moscow.

BICC Ltd have supplied 50,000 yd of p.v.c. cable for the internal wiring of Flyover Hse, Brentford, which houses the Electrical and Mechanical Division of Geo Wimpey Ltd.

Many salmon smolts have been trapped and killed in the sump at Berkeley nuclear power station. A working party has been set up to consider temporary measures for ensuring others keep alive.

For the three months ending 30 June, 159 farms and 205 rural premises were connected to mains supply in the Lakeland sub-area of NWEB.

SWEB have purchased Trengweath, Penryn St, Redruth, for use as offices.

AEI (Manchester) have delivered their 135th and last locomotive to South African Railways. This is because of the "buy South African" policy of Dr Verwoerd's Government.

A resolution asking that fuel oil used in generating stations should be exempt from tax has been passed by Merseyside and North Wales Electricity Consultative Council.

"The Impact of Industrial Development on the Countryside" is to be the theme of the national conference of the Council for the Preservation of Rural England, to be held at Southport from 12 Oct. to 14 Oct.

Gloucester Society has bought for £41,000 the Midlands Electricity Board's service centre at the corner of Brunswick Rd and Eastgate St, Gloucester.

OVERSEAS NEWS

from our correspondents abroad

CANADA

BCE Takeover

The British Columbia Legislature gave unanimous approval to the Expropriation Bill for BC Electric and Peace River Power Development recently. The Premier said that the takeover, estimated to cost £235 million, would increase the province's debt to £465 million. To finance the takeover, an issue of £36 million in 5% parity bonds was announced. The Bill recognises two alternatives for compensating the holding company, BC Power. Either a direct payment of $111 million, or a complete takeover of BC Power in return for which shareholders would receive $38 a share. However, BC Power directors do not consider these terms give adequate compensation. Compensation terms for the Peace River Power Development Co. are to be determined by the comptroller-general for the province. The BC Premier also announced that the chairman of the BC Energy Board, Mr Gordon Shrum, will become chairman of BCE. Directors include Messrs F. M. Ross, E. M. Gunderson, R. Williston, A. Fouks and W. Mearns.

Power for Chemical Plant

A thermal electric station is to be built at Tracy, 40 miles north east of Montreal, to supply power to a $20 million petro-chemical plant on the city outskirts. The plant is to be built by Shawinigan Water and Power Co. The power station will have two 150 MW sets and these are scheduled for operation in 1964 and 1965.

Nuclear Plant Study

A joint study on the cost of building a large nuclear power station in India is to be undertaken soon by Canada and India at India's request. The study is expected to cost about $50,000.

New Brunswick Cuts Rates

Rate reductions varying from 25% for some residential consumers to 6% for some industrial users will result from the satisfactory operation of the New Brunswick Electric Power Commission last year. Gross sales of power for the year ended 31 March rose by 13·8% to about $19 million while operating expenses rose by 10·4% to $17·7 million. Total surplus for the year before reserves was $1,263,551. The Commission, with a financial guarantee by the province, is now carrying out its own long-term financing. During the year, assets increased by nearly $10 million mainly as a result of new transmission lines, terminal stations and additions to the distribution system. One result of last summer's low water flow was a considerable increase in power purchase from the Nova Scotia system.

Quebec Increases Earnings

Operating revenue of Quebec Power increased substantially to $9,258,080 for the first half of this year, compared with $8,508,112 for the first half of 1960. Operating expenses rose by 9·1% to $8,192,411.

Views on Common Market

Some views on how Britain's joining the Common Market will affect Canadian trade were expressed recently. The president of General Steel Wares thought that refrigerators and other household appliances now entering Britain from the Commonwealth would retain their market on the basis of advanced design, but ultimately it would be necessary for Canadian firms to build manufacturing plants in Britain, or make manufacturing agreements with British companies. For such companies as Canadian General Electric, preferential treatment by Britain is less important than preferred entry into other Commonwealth markets. This company exports little to Britain, but it has a considerable market for heavy electrical equipment in Australia and New Zealand.

Gold River Inquiry

Plans for two 17,000 h.p. hydro plants on the Gold River proposed by the Nova Scotia Light and Power Co. were discussed at a recent inquiry. There was some opposition to the scheme on the grounds that it will destroy salmon in the river. The plant is intended to provide seasonal peak power varying from 37-64 million kWh a year.

Hydro-electric Battlefield

An unusual aspect of the wayleaves problem is giving Quebec Hydro some trouble. The site for their Carillon project is maintained in some quarters to involve flooding a battlefield where the Indians were fought by des Ormeaux.

However, the Resources Minister said recently that he cannot delay work on the project while historians decide exactly where the actual battlefield was.

Underground Lines Urged

A national campaign to focus attention on the need to rid urban areas of overhead power and telephone wires is being urged by the Royal Architectural Institute of Canada. The Association of Municipal Electrical Utilities of Ontario has already emphasised that unless the public are prepared to accept the higher costs involved, it would be almost impossible for the utilities to spend money on improving the aesthetics of their installations.

Paper Drive Contract

Regulating equipment and d.c. motors totalling 6,400 h.p. are to be supplied for a paper mill drive at Port Alberni by Canadian General Electric. Claimed as the largest newsprint machine in the world, it will run at 3,000 ft/min.

ARGENTINA

New Traction Plant Factory

Electrical equipment, with the emphasis on motors and generators for traction purposes, will be produced at a factory opened recently at San Justo by Siam Di Tella Electromecanica.

CANARY ISLANDS

Power and Water Plan

Intended to operate primarily in the Canary Islands, a new Spanish company has been formed with the title of Termoeléctrica de Lanzarote, and a capital of 30 million pesetas. This concern aims to produce electric energy and distil sea water.

EGYPT

Nuclear Reactor Under Test

The first nuclear reactor to be erected in the United Arab Republic began operation at the end of July. The reactor, built with Soviet assistance, has a rating of 2 MW. Sited in a suburb of Cairo, the reactor is intended for nuclear physics research, production of radioactive isotopes and biological research.

PAKISTAN

Power Shortage by 1965

A report on power consumption in East Pakistan, prepared by WAPDA consultants, suggests power shortages will be experienced from 1965 onwards. Studies of alternative methods of thermal generation are considered necessary in the absence of sufficient hydro resources.

Self-help Generation

The town committee of Nushki, in the Quetta division, recently had their 52 kW power station opened by the Quetta Commissioner. At the opening, the Commissioner said he was trying to get power houses installed in other towns in the division, for small power houses were most suitable for those towns and villages which were at great distances from the main generating stations.

Rural Extensions

By the end of the year the West Pakistan primary grid will be extended from Bahawalpur to Sadiqabad. The

districts of Bahawalpur, Bahawalnagar and Rahim Yar Khan are to be electrified during the current year.

Power Survey

As part of WAPDA's plans for electrifying within the next ten years every town and large village in West Pakistan, a door-to-door survey of power requirements is to be carried out. The survey will cover both domestic and industrial requirements for immediate and future schemes and it will subsequently be analysed by the authority's consultants, Messrs Harza Eng. Int.

INDIA

Durgapur Expansion

An agreement is expected shortly for the extension of the Durgapur steel plant to provide a further 0·6 million tons capacity. The agreement between Britain and India will make British credit available only for the purchase of UK equipment, but the purchases will not be limited to members of the ISCON consortium. The Germans, who have made a credit offer to India, are reported to be uneasy because they fear it may be used for purchases from non-German sources. Indian imports are largely from the USA, notwithstanding higher costs of American plant.

Funds for Power Development

Power developments in India are likely to receive over $100 million from the Aid-India Club. This is expected to be sufficient to meet nearly all the projects selected for development and intended to add a further 7·6 million kW of generating plant during the third Five-Year Plan. Bulk of the allotment is expected to come from West Germany with a substantial contribution from Japan.

AUSTRALIA

Murray No. 1 Contracts

Three important contracts have been awarded for the Murray 1 station of the Snowy Mountain scheme. In addition to the eight 130,000 h.p. water turbines to be supplied by Boving and Co., the 95 MVA alternators will be built by ASEA (Australia) and 13 transformers are to be built by Canadian General Electric.

Hazelwood Station

A new coal-burning station with a capacity of 1,200 MW is to be built at Hazelwood in the Latrobe Valley for completion by 1971. The new plant will nearly double the electrical generating capacity in Victoria and will consume 13 million tons of brown coal annually.

Hydro Schemes Authorised

After a stormy passage through the House of Assembly, the Bill authorising an expenditure of nearly £12 million for the Lower Derwent power scheme was passed last month. At another session, the House agreed to ask the Governor to appoint a board of inquiry into certain aspects involving thermal and hydro-electric power generation in Tasmania. This request arose from a dispute over whether a thermal or hydro station should be built in Fingal Valley.

Tallawarra Fully Commissioned

Earlier this month the second 100 MW turbo-generator unit at the Tallawarra power station for the Electricity Commission of New South Wales was brought into regular service. Commissioning of this set brings the power station to its full capacity of 320 MW.

Switch Manufacture

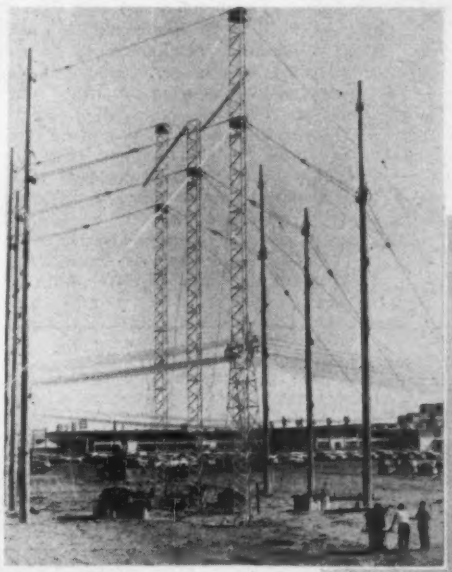
A technical assistance contract has been signed by Hitachi, of Tokyo, with an Australian firm, Endurance Electric Pty. Ltd., the contract covers the manufacture of line switches and involves £6,000 for technical information and royalties equivalent to 3% of sales.

U.S. USES ALUMINIUM FOR SUPPLY

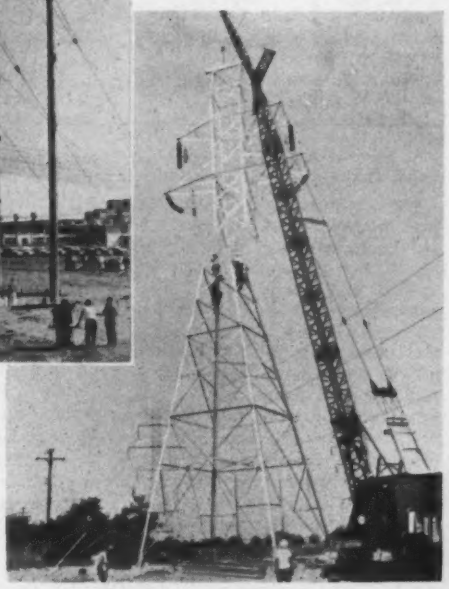
ALUMINIUM is increasingly being applied in the USA for the construction of transmission towers and substations. An all-aluminium substation design has been evolved by Philadelphia Electric, and 12 of these are now operating on system voltages from 33 kV to 220 kV. The design employs a single bus with one circuit-breaker for each line. Vertical members of "H" section alloy are used, welded to "I" beam cross members. Bus and conductors are of aluminium pipe with all tapping points welded. Only connections to switches and other equipment are bolted. Although about 10% more than steel structures in first cost, the all-aluminium substations are said to have an erection cost only 75% that of steel. Cost of maintenance is also reduced and earthing of voltage transformers and other items is by bolting directly to the structure.

Five designs of steel/aluminium transmission tower, ranging in height from 77 ft to 133 ft, are to be installed on the 115 kV double-circuit lines from Niagara by Niagara Mohawk Power. The tower bases are of steel while the upper works and crossarms are all-aluminium. Once again, the higher first cost is expected to be more than compensated for by reduced maintenance and by a reduction in assembly cost of one-third compared with all-steel towers.

All-aluminium towers with extruded section vertical members are to be installed on a 230 kV line by Portland General Electric. The towers are unusual in having triangular, rather than four-sided legs. Three-legged towers for a 115 kV circuit have also recently been installed by United Illuminating. The leg of this tower design is an extruded section in the form of an "M," giving a 70% weight reduction over a steel tower.



All-aluminium transmission tower under test at the Alcoa plant. The 90 ft tower for 230 kV circuits has only three legs



Positioning the aluminium top on a composite steel/aluminium tower for the double-circuit 115 kV line of Niagara Mohawk Power. Two hundred similar towers have been fabricated for the line by Alcoa

Company Activities

MUCH like those stalwarts whom the Grand Old Duke of York marched up the hill and then marched down again, so share prices on the London Stock Exchange last week were once more on the down-slope after their phenomenal climb the week before. From measuring their tread by the *Financial Times* industrial ordinary share index—up from 306·5 to 328·6 and then down again to 313·0—it can be correctly concluded that the market is best left in these "see-saw" conditions to the speculator and the professionals.

After their first "inflationary" fling it appears that the trustees are now holding off the market, and while selling of equities on the public's part is undoubtedly taking place, albeit small, it is the absence of buyers which is really knocking the share indices.

Most electrical issues after their recent rocketry were also last week inclined to succumb to these gravitational pulls, so that AEI dropped back from 37s to 35s 9d, GEC from 31s 6d to 30s and English Electric eased from 32s 3d to 31s. Decca Ordinary came back 1s 9d to 64s 3d, EMI were 1s 3d less tuneful at 39s, while International Computers and Tabulators calculated a 3s fall over the week at 92s 9d.

On the company news front, the biggest item, of course, was the Plessey takeover proposals for Automatic Telephone and Electric and Ericsson Telephones. If the cash and share terms of this £55 million merger are fully accepted it will mean Plessey shareholders (after the proposed one-for-three free scrip issue) will hold 61·7% of the new group's equity, ATE Ordinary shareholders 21·1% and Ericsson Ordinary shareholders 17·2%. One of the chief objects of the exercise is clearly the need to avoid the considerable overlapping of effort and will lead to a more intensive and efficient use of research and production facilities in the telecommunications field.

No doubt the merger will prove to be in the long-term interests of all three, but the market's immediate reaction was to mark Plessey's 10s Ordinary shares sharply down from 55s 6d to 50s after starting out the week at 57s, but by the close they had recovered to 51s 6d. On the other hand, the 5s Ordinaries of ATE started out at 14s 6d, were marked up from 14s 9d to 16s 6d on the terms and closed at 16s 10½d. Ericsson saw their 5s Ordinaries fall from 28s 3d to 27s 3d before the announcement, but they rose to 28s 6d on the news and then finished at 28s 9d.

Mr Jules Thorn's "bullish" yearly report failed to stop a down-drift in Thorn shares from 50s to 49s. Nevertheless, few would disagree with the confidence of dynamic Mr Thorn, who has steered profits from £231,738 in 1949-50 to £4,113,907 for the latest year. Readers of Thorn's latest balance sheet will also discern with keen interest that capital and revenue reserves now amount to £9·8 million against an issued Ordinary and "A" Ordinary capital of only £2,187,708. Back in August, 1960, shareholders defeated a then proposed one-for-one free scrip issue. Now, a year later, second thoughts on the market background could lead easily and perhaps soon to a second attempt by the board to secure shareholders' approval to a part-capitalisation of these huge reserves. Certainly, the 5s Ordinary shares at 49s, 14s back from their 1961 peak price of 63s, do not look unattractive with the 25% dividend three times covered. Although the dividend yield is now down to 2·5%, the group's growth potential must also mark Thorn as a likely counter for the generality of equity-seeking trustees.—*From our City Correspondent.*

John Brown

The consortium formed during the year by John Brown Land Boilers Ltd. and Foster Wheeler for the design and construction of central station boilers in the UK and Eire is "well and happily" established, says Lord Aberconway in his annual review. It has been awarded the contract for four 350 MW boilers for the new Tilbury station and will be tendering for other boilers, including some 500 MW units. Like others in the field, however, this grouping is feeling the pinch as a result of boilers being larger and orders fewer. Price margins are described as "quite inadequate" in relation to the skill, technical risk and capital involved. Concerning the S. N. Bridges subsidiary, the chairman says turnover of portable electric tools has been maintained, despite intense competition, and Luxury Life domestic appliances have been well received.

Cable and Wireless

Telegraph traffic rose by 5% and radiotelephone traffic by 5·4% in the year to 31 March, with the result that profit before tax was just over £1 million higher at £4,440,462. The dividend, which is payable to the Treasury, goes up by 1½% to 5½%. Results this year may not be quite so good, but should still be satisfactory, the directors say. The report shows a changing pattern of operations, with retracting ownership in some newly independent countries being offset by expansion in the more highly developed techniques, such as radiotelephony and phototelegraphy. Close attention is being paid to the possibilities of communication via satellites.

Christy Bros.

Dividend is raised from the established 8% rate to 10% as a result of a strong recovery in earnings. Pre-tax profit is doubled from £49,694 to £100,820 for the year to 31 March.

A. C. Cossor

Directors recommend the takeover bid from Ratheon of Delaware, US, and Treasury consent has been applied for.

Richardsons, Westgarth

With John Brown's prepared to build the new "Queen" on an unprofitable basis, in order to keep their Clydebank yard working, it is not surprising to find that Richardsons, Westgarth are reorientating their operations away from marine work. At the RW annual meeting last week, the chairman, Mr O. J. Philipson, told shareholders there would have to be greater dependence in future on land work. The arrangement with GEC earlier this year to collaborate on producing complete power stations suggests how this is to be achieved. As another step to meet the changing pattern, RW have decided to switch from the relatively self-contained subsidiary structure to centralised control.

Thorn Electrical

"It is not my habit," says Mr Jules Thorn, "to make optimistic forecasts," and he confines himself to saying that the group is as well placed as any in the electrical industry, as far as the future is concerned. Nevertheless, an analysis of his annual review suggests that another good profit is likely this year. Investment in fluorescent lighting is really paying off. Atlas Lighting had a record year in both turnover and profits, with a "considerable improvement" in every section, and the order book now is higher than a year ago. Special products division had its best year ever and demand for Thorn connectors continues to rise. Even domestic appliances did well, with Tricity cookers increasing profits substantially and the overall order book in a healthy condition. Even radio and TV increased its share of the market, though at a lower level, and the chairman is confident that progress will continue. The export picture is bright and overseas subsidiaries are expanding.

Year to 31 Mar.	£ Trading Profit	£ Net to Parent	% on Ord. Earned	% on Ord. Paid	Ord. Price* High	Ord. Price* Low
1957	2,121,249	592,637	62·9	17½	27/3	16/3
1958	2,343,238	643,454	67·0	17½	28/3	19/9
1959	2,953,536	932,474	91·8	20	57/3	26/3
1960	3,916,990	1,475,110	109·0	25	55/9	40/0
1961	4,113,907	1,500,470	110·9	25	63/9	44/6

* Calendar year except 1961, which is up to 4 July

Dividend Announced

English Electric. Interim 3% (*same*).

MORE POWER FOR INDUSTRY

WITH

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CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London, W.C.1

The "EXEL" Range of Switchgear

Complies with B.S. 2510: 1954

RATINGS: 15-30-60-100 AMPS

500 VOLTS A.C. or D.C.

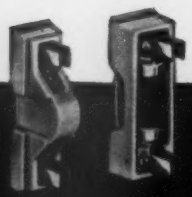
Modern buildings demand switchgear of sound technical performance and compliance with the latest relevant British Standards, and that is in harmony with the most modern surroundings. The 'Exel' range of switchgear will meet all these requirements.

Fuses are of the new 'Kantark-Exel' pattern which will accept semi-enclosed rewirable or H.R.C. Fuses.

Semi-enclosed rewirable (damper type) patterns comply with B.S. 3036: 1958.

Fabricated cases are of heavy gauge sheet steel with hinged covers, rust-proofed and finished grey stove enamel. Chrome plated front operating switch handles.

Removable endplates are provided at top and bottom of case with semi-pierced knockouts which, on removal, provide clearance holes for conduit.



H.R.C. cartridge patterns, which are interchangeable with the semi-enclosed rewirable patterns, comply with B.S.88: 1952.

M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links to B.S.88:1952, Appendix 'J' Dimensions, Form A-Offset Tags.

All live metal is adequately shielded to avoid accidental contact when cover is open. The porcelain shields also serve as efficient arc barriers.

Wiring space is generous. A detachable switchbar facilitates wiring.

All units are arranged for internal fixing. Keyhole slots are provided at top. There are no external lugs.

The 'Exel' range ensures compliance with the most strict interpretation of I.E.E. Regulations (13th Edition), and with the requirements of The Electricity (Factories Act) Special Regulations.

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MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE, TYSELEY, BIRMINGHAM, 11

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

17 Aug.—Down C.C. Heating and lighting installation in new clinic and library, Braniel.—See 3 Aug. issue.

17 Aug.—N.I. Hospitals. (Contract (b)(3).) Provision of electrical engineering services in erection of new ward block at Royal Maternity Hospital, Belfast. Secretary, 27 Adelaide St, Belfast 2. Applications by 5 p.m. on above date.

17 Aug.—S. Liverpool Hospitals. Electrical upgrading work at Sefton General Hospital. —See 10 Aug. issue.

18 Aug.—Tottenham B.C. 1,090 Group "B" concrete columns/brackets; (b) supply of 60 W sodium lanterns; (c) supply of 60 W sodium control gear.—See 3 Aug. issue.

19 Aug.—Brierley Hill U.D.C. Electrical installation in Assembly Hall (Phase 3). Applications to Architect and Housing Director: J. R. Moore, Civic Bldgs, by above date.

19 Aug.—Selkirk C.C. (2) Electrical work in Galashiels Academy.—See 3 Aug. issue.

21 Aug.—Burnham-on-Sea U.D.C. 30 mercury, 85 sodium and 38 fluorescent lanterns/lamps/gear and the supply/erection/wiring of 123 concrete columns along B3140.—See 10 Aug. issue.

21 Aug.—Heston and Isleworth B.C. Rewiring, etc., 40 houses, Warren estate, St. Aubyn's Ave.—Advertised 27 July issue.

21 Aug.—Lancashire C.C. Rewiring of Leigh Bedford Methodist School. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date.

21 Aug.—N.I. Housing Trust. Electrical installations in 261 dwellings, Rathcoole Development II. Trust Offices, 12 Hope St, Belfast 12.

21 Aug.—North Riding C.C. Mercury vapour lighting at two roundabouts.—Advertised 3 Aug. issue.

21 Aug.—Sowerby Bridge U.D.C. (a) Electrical installations and intercom. system in 38 aged persons' dwellings, warden's house and meeting room at Bairstow La and Throstle Mount.—See 10 Aug. issue.

22 Aug.—Bournemouth C.B.C. Electrical installation improvements, on fixed-price basis, at Municipal College, Dept. of Commerce, Princes Hotel, Knyveton Rd, Boscombe.—See 10 Aug. issue.

23 Aug.—Antrim C.C. (a) Electrical installation in new Derriaghy Primary School. Details from consulting engineer: J. Waring, 31 High St, Carrickfergus. Deposit £5.

23 Aug.—Kingston upon Hull C.C. Electrical installations in (a) 219 dwellings, Boothferry estate, and (b) 63 dwellings on various estates. City Architect's Dept. Deposit £2 each item payable to City Treasurer.

24 Aug.—Hoylake U.D.C. 208 140 W sodium lamps/gear for Group "A" conversion scheme.—Advertised 3 Aug. issue.

24 Aug.—Manchester C.C. Supply of lamps for year to 31 Dec., 1962. City Surveyor, Town Hall.

25 Aug.—Braintree and Bocking U.D.C. Wiring of two groups of 28 houses, Wheatley Ave.—See 27 July issue.

26 Aug.—Alfreton U.D.C. Installation of 179 lighting units comprising "Atlas" sodium lamps and "Stanton" concrete columns. Engineer and Surveyor, Council Offices, Nottingham Rd. Deposit £2 2s.

26 Aug.—Ballinasloe (Co. Galway). Electrical installation in Ballinasloe Mental Hospital new dining hall and renovations to existing hospital in the Pines Division. Details from consulting engineers: J. A. Kenny and Ptnrs., 44 Kildare St, Dublin. Deposit £5 5s.

26 Aug.—Bradford B.C. Installation of electric wiring, three dwellings, Scar Hse Reservoir, Harrogate.—See 29 June issue.

26 Aug.—East Barnet U.D.C. 13 15 ft concrete and 37 c.i. columns/brackets, resiting of 139 columns and erection of 116 columns; supply and fitting of 395 60 W sodium lighting; wiring.—See 3 Aug. issue.

28 Aug.—Birmingham C.C. Firm-price basis tender. Lighting, power and heating installations in tenants' rooms at: contract T50/8, Bottetourt Rd, Birmingham 29; and contract T50/17, Ley Hill, Holloway.—See 10 Aug. issue.

28 Aug.—Bury St. Edmunds B.C. Inspection of electrical installations in 65 temporary dwellings.—See 27 July issue.

28 Aug.—E. Devon Water Board. Supply of duplicate pumps for 1,200 g.p.h. at 441 ft head for Colyford booster station. Chief Engineer, 46 New St, Honiton.

28 Aug.—Liverpool C.C. Supply of cables, lamps, sundries and scientific electrical engineering equipment. Central Purchasing Officer, 75 Dale St, Liverpool 2.

28 Aug.—Manchester C.C. Electrical installations in workshop and foundry extensions at Openshaw College of Further Education. City Architect, P.O. Box 488, Town Hall.

28 Aug.—Manchester C.C. Supply and installation of passenger lift at "Heyhead View" aged persons' home, Wythenshawe.—See 10 Aug. issue.

28 Aug.—Welwyn Gdn City U.D.C. 82 steel lighting columns/lanterns and removal of existing columns.—See 3 Aug. issue.

29 Aug.—Cardiff C.C. Supply and installation of passenger lift in aged persons' home, Newborough Ave, Llanishen.—See 3 Aug. issue.

29 Aug.—Cardiff C.C. Electrical installation, on fixed-price basis, in Brynydon Approved School extensions, Dinas Powis.—See 10 Aug. issue.

29 Aug.—Dublin C.B.C. Supply of 40 aluminium alloy columns and post-top lanterns, underground cable and 1,000 fuse boxes.—See 10 Aug. issue.

30 Aug.—Hayes and Harlington U.D.C. Contract 627. Supply of Group "B" steel lighting columns, Stewarts and Lloyds GB 1005 or similar.—Advertised 10 Aug. issue.

31 Aug.—Bala U.D.C. 13 Group "A"' steel columns and six wall brackets with 250 W mercury lamps/lanterns/gear.—Advertised 10 Aug. issue.

31 Aug.—Enniskillen. Electrical installation in proposed St. Michael's Grammar School extensions.—See 10 Aug. issue.

31 Aug.—Hants C.C. Supply and erection of 13 35 ft steel columns complete with 200 W or 280 W sodium lighting for Bullington A303/A34 roundabout. Applications to County Surveyor, The Castle, Winchester, by above date.

31 Aug.—Lisburn. Rewiring of lighting and heating installations in Railway St Presbyterian Church. Details from consulting engineer, Wm. J. Ogle, 63 Main St, Bangor, Co. Down. Deposit £5 5s.

1 Sept.—Belfast C.C. 33 kV switchgear, together with modification of existing plant. —Advertised 3 Aug. issue.

1 Sept.—East Riding C.C. Electrical services installation in proposed Cottingham (Bacon Garth) Infants' School. County Architect, County Hall, Beverley.

1 Sept.—N. Armagh Hospitals. Electrical work in Lurgan and Portadown Hospital alterations and additions.—See 3 Aug. issue.

1 Sept.—Thurrock U.D.C. Erection of columns included in road improvements, Heath Rd and Long La.—See 27 July issue.

4 Sept.—Chatham B.C. Supply, nominated manufacturers, and erection complete of 1,080 Class "B" lighting units.—Advertised 10 Aug. issue.

4 Sept.—Flint C.C. Supply of concrete or steel columns, lanterns/lamps/fittings for Queensferry By-pass lighting. County Surveyor, Llwynegrin, Mold.—Advertised in this issue.

4 Sept.—Gt. Yarmouth C.B.C. 2,000 g.p.m. at 45 ft head sea water pumps for use at swimming pool and boating lake—See 10 Aug. issue.

4 Sept.—N. Ireland E.B. Main generator/generator transformer connections for No. 4 60 MW turbo-generator.—See 6 July issue.

4 Sept.—Rochdale C.B.C. Rewiring of lighting and power installations in Oakenrod Primary School. Borough Surveyor, Town Hall.

5 Sept.—Athlone U.D.C. Two pumps with capacity of 11 cu ft p.m. for main drainage pumping plant.—See 3 Aug. issue.

5 Sept.—Cardiff C.C. Electrical installation and heating and allied services in Adamsdown County Primary School.—See 10 Aug. issue.

5 Sept.—West Riding C.C. Installation of road lighting at Tadcaster Toulston Lodge Secondary School.—See 10 Aug. issue.

6 Sept.—Preston C.B.C. Contract 8. Electrical installations, on fixed-price basis, in eight shops, 13 maisonnettes and branch

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Novalux" fan heaters—address for? L.B.—Truvox Ltd., Neasden La, N.W.10.

"Copperad" heaters—makers of? E.B. —Copperad Ltd., 1 York St, W.1.

Electric animal goads—makers of? T.B. —Cooper-Stewart Eng. Co. Ltd., Wks, Rd, Letchworth, Herts; Wolseley Eng. Ltd., Electric Ave, Witton, Birmingham 6; Holborn Surgical Instrument Ltd., 15 Charterhouse St, E.C.1.

Hiatt and Co. Ltd. makers of cable clips—address for? A.E.A.—Baltimore Rd, Birmingham 22b.

Whole house ducted air central heating (single source) systems—makers of? E.D. —Gnome Heaters (Sales) Ltd., 1 Cater St, Bradford; Lorne Stewart (Heating) Ltd., Ardsheil Hse, Empire Way, Wembley, Middlesex; Lectra Heat Ltd., 79 Gregory Boulevard, Nottingham.

"A.E.M." starters—makers of? E.B.—Airedale Electrical and Mnfg Co. Ltd., Harrogate Rd, Apperley Bridge, Bradford.

Sealing wax heaters—makers of? E.B. —Barlow-Whitney Ltd., Coombe Rd, Neasden, N.W.10; Dowsing Co. (Electrical Mnfrs) Ltd., 100 Holdenhurst Rd, Bournemouth; C. H. Blackburn and Co. Ltd., 10 Gray's Inn Rd, W.C.1.

library, Savick estate. Borough Engineer and Surveyor, Municipal Bldgs. Deposit £2 2s.

6 Sept.—Staines U.D.C. Supply and erection of 190 Group "A" steel columns with 250 W mercury lanterns/lamps/gear; 190 Group "B" steel columns with 100/150 W tungsten lighting plus resiting work with new lanterns, etc.—Advertised 10 Aug. issue.

7 Sept.—Belfast C.C. (b) Electrical installation in Somerdale Boys' Secondary School, Somerdale Pk. City Architect's Dept., 40 Academy St, Belfast 1.

7 Sept.—Belfast C.C. (b) Electrical installation in Diagnostic Centre.—See 10 Aug. issue.

8 Sept.—Stockton-on-Tees B.C. Supply of: (a) 13 Group "A" reinforced concrete columns and (b) 13 140 s.v.d. lamps, lanterns/gear. Borough Engineer and Surveyor, Gilbert Cowan, Municipal Bldgs, Church Rd. Deposit £2 2s each item.—Advertised in this issue.

9 Sept.—Prescot U.D.C. Supply and erection of 54 "A.E.I. Kirby" lanterns mounted on 15 ft "Concrete Utilities" columns, together with lamps/gear along various roads. Engineer and Surveyor, Council Offices.

9 Sept.—Wexford C.C. Electrical installation in public health clinic, Enniscorthy.—See 10 Aug. issue.

11 Sept.—Newcastle under Lyme B.C. Supply and installation of 35 Group "A" 200 W sodium lighting units, including conversion fittings for existing columns, etc., for A52 Tarporley/Tarvin trunk road. Borough Engineer, Lancaster Bldg, High St. —Advertised in this issue.

11 Sept.—N. Ireland. Standby generating set for Ministry of Home Affairs, Radio Workshops, Lislea Drive, Belfast 9.—See 10 Aug. issue.

11 Sept.—Uxbridge B.C. Rewiring of lighting circuits and power installations in: contract 111: 150 houses, Hillingdon; contract 112: 152 houses, Hillingdon; and contract 113: 130 houses, Cowley. Housing Manager, A. W. Caudery, 267 High St. N.I.C. firms only.—Advertised in this issue.

14 Sept.—Sunderland C.B.C. Electrical installations in (a) Training College extensions and (b) Hylton Red Hse Community Centre. Borough Architect, Grange Hse, Stockton Rd.—Advertised in this issue.

16 Sept.—Morley B.C. Supply, installation and putting into service of 52 140 W sodium street lighting units on 25 ft concrete columns (22 columns to support o./h. wiring) along A62. Public Lighting Engineer, Town Hall.—Advertised in this issue.

18 Sept.—E.B. for N. Ireland. Specification N.I.1638. Supply of two 200 kVA and two 300 kVA 3·3/0·4 kV transformers for Coolkeeragh Power Station.—See 27 July issue.

18 Sept.—Poyton-with-Worth P.C. Provision and erection of 55 concrete columns and sodium lanterns for Class "A" street lighting. Council Offices, 220 Park La.—Advertised in this issue.

16 Oct.—E.B. for N. Ireland. Contract N.I.1621. Supply and erection of low pressure pipework and valves at Coolkeeragh. Applications to consulting engineers, Kennedy and Donkin, 64 Royal Exchange, Manchester 2, by 1 Sept. Deposit £5 5s. made payable to E.B. for N. Ireland.

TRADE NOTES

Changes of Address. Abis and Co. (Birmingham) Ltd., repetition workers, have moved to Dennis Rd, Sparkbrook, Birmingham 12. Telephone: South 3781.

As from 1 Sept., Celcure Ltd. new address will be Kingsway Hse, Kingsway, W.C.2. Telephone: Chancery 8325.

The Birmingham office of Tickopres Ltd. will move to larger premises at Commercial Hse, 37-40 Bromsgrove St, Birmingham 5, during September. Telephone: Midland 5850.

Group Sales. Co-ordinating office has been established at the Blackwood factory of South Wales Switchgear Ltd. for the outside sales of Aberdare Cables Ltd., South Wales Switchgear Ltd., Aberdare Eng. Ltd. and Neckar Water Softener Co. Ltd.

No date stated—Huddersfield C.B.C. Electrical and passenger lift installations together with supply and installation of kitchen equipment in home for aged, Reinwood.—See 3 Aug. issue.

No dated stated—N. of Scotland H.E.B. Supply of 16·5 MVA 132/11 kV transformer and auxiliary transformer for Awe Project, Nant Power Station. Details from Strain and Robertson, 5 Park Circus, Glasgow C.3. Deposit £2 2s.—Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

25 Aug.—Argentina. 33 kV line between Lobos and Navarro. Direccion de la Energia, Calle 6, No. 636, La Plata, Provincia de Buenos Aires. B.o.T. (ESB/24927/61).*

29 Aug.—Egypt. Watthour meters, current transformers, etc. Stores Dept., Cairo Electricity and Gas Administration, 53 Sharia July 26, Cairo. B.o.T. (ESB/25271/61).*

30 Aug.—India. 48 30 in. 10,000 cu ft/min mine booster fans, complete. General Manager, Singareni Collieries Co. Ltd., Kothagudium Collieries P.O., Bhadrachellam Rd Station, Central Railway, Deccan. B.o.T. (ESB/25296/61).*

31 Aug.—Australia. Three precision watthour standards and one photoelectric control unit. General Manager, Sydney C.C., Box 4009, G.P.O., Sydney. B.o.T. (ESB/24350/61).*

1 Sept.—India. 150 flameproof coal drill transformer panels. General Manager, Singareni Collieries Co. Ltd., Kothagudium Collieries P.O., Bhadrachellam Rd Station, Central Railway, Deccan. B.o.T. (ESB/25298/61).*

1 Sept.—Turkey. Application for inclusion in tender lists for hydraulic turbines, generators, transformers and telephone relays to Devlet Su Isleri Umum Mudurlugu, Barajlar ve Hidroelektrik Santrallar Dairesi Reisligi, Bestekar Sokak 25, Ankara, by above date. B.o.T. (ESB/25000/61).*

2 Sept.—Iraq. Insulators h.t. Directorate General of Municipalities. B.o.T. (ESB/24969 and 70/61).*

3 Sept.—Iraq. Cables and accessories, l.t. for Margil. Office of Mudir, Purchase and Tender, Iraqi Ports Administration, Basrah. B.o.T. (ESB/24923/61).*

3 Sept.—Kuwait. Conduit fittings, switches, switch sockets and plugs. President, Dept. of Electricity, Water and Gas. B.o.T. (ESB/25213/61).*

5 Sept.—India. 23,775 metres p.i.l.c.s.w.a. 2-core lighting cable and 2,468 metres of 4-core p.i.l.c.d.w.a. cable. Assistant Elec. and Mech. Engr. (P1), National Coal Development Corpn., Barbhanger Hse, Ranchi. B.o.T (ESB/25241/61).*

13 Sept.—Iraq. 6,600 batteries (13 items). Ministry of Defence, Directorate of Contracts and Purchases, Baghdad. B.o.T. (ESB/24307/61).*

19 Sept.—Ceylon. 8,000 yd 1·1 kV 4-core armoured cable of 0·1 sq in. and 0·25 sq in. Chairman, Tender Board, Ministry of Agriculture, Land, Irrigation and Power, P.O. Box 500, Colombo. B.o.T. (ESB/25255/61).*

19 Sept.—Portuguese East Africa. Distribution network for Tete. Public Wks. Dept., Lourenco Marques. B.o.T. (ESB/24978/61).*

28 Sept.—Australia. Six diesel-electric main line locos. Secretary, Western Australian Govt. Tender Board, 74 Murray St, Perth. B.o.T. (ESB/24336/61).*

Gazette Announcements

COMPANIES ACTS

Carwood Electrical Supplies Ltd. Winding-up order dated 17 July.

Greenaway Swanson and Co. Ltd. Meetings of creditors and contributories to be held at Official Receiver's Office, 26 Baldwin St, Bristol 1, on 22 Aug., at 11 and 11.30 a.m., respectively.

Scott Jones and Co. Ltd. Meetings of creditors and contributories to be held at Official Receiver's Office, 26 Baldwin St, Bristol 1, on 18 Aug., at 11.30 a.m. and 12 noon, respectively.

Peto Scott Electrical Instruments Ltd. Last day for receiving proofs for intended dividend to unsecured creditors: 22 Aug., by liquidator: K. R. Cork, 19 Eastcheap, E.C.3.

Audiovision (Electrical) Ltd. Meeting of creditors to be held at Friends' Hse, 173 Euston Rd, N.W.1, on 22 Aug., at 2.30 p.m.

Singleton, Nelson and Co. Ltd. Meetings of creditors and contributories to be held at Official Receiver's Office, 27 Regent St, Park Row, Nottingham, on 18 Aug., at 12 noon and 12.30 p.m., respectively.

Telex Ltd. Meetings of creditors and contributories to be held at Room 401, Inveresk Hse, Strand, W.C.2, on 18 Aug., at 10.15 and 10.45 a.m., respectively.

BANKRUPTCY ACTS

Intended Dividends

Plymouth. D. Boulton and L. C. Turner, wireless and electrical engineers, formerly carrying on business as Derek Boulton at Old Town Ave. Last day for receiving proofs for intended dividend: 22 Aug., by trustee: A. D. Gwyther, Royal Bldg, St. Andrew's Cross, Plymouth.

Tunbridge Wells. J. H. Pickwell, electrical engineer, contractor, etc., formerly carrying on business at 79 and 108 London Rd, East Grinstead. Last day for receiving proofs for intended dividend: 23 Aug., by trustee: H. T. Parker, 8 Old Steine, Brighton 1.

Release of Trustee

Ipswich. J. S. R. Morley, plumber and electrical engineer, formerly carrying on business at Grove Cottage, Botesdale, near Diss, and formerly in partnership as Morley and Bishop at The Street, Redgrave, near Diss. Trustee: C. A. Taylor, 3-5 Northgate St, Ipswich, released as from 31 July.

CONTRACTS PLACED

C.E.G.B. (South Eastern Region). Contracts placed during July amounted to £204,956 and included: Battersea, 2 ton goods lift, Evans Lifts Ltd.; Eltham, 2 45 MVA 132/33 kV transformers, Brush Elec. Eng. Co.; Folkestone, 11 kV switchgear mods., A. Reyrolle and Co.; Folkestone, 132 kV switchgear, English Electric Co.; Maidstone, 11 kV switchgear, South Wales Switchgear; Purley, 33 kV switchgear, A. Reyrolle and Co.; Chelmsford, transformer transfer, A.E.I. Ltd.; King's Lynn, 132 kV o./h. lineworks, Balfour Beatty Ltd.; Luton, 33 kV switchgear, E.E. Board.; Wickham Market, transformer transfer, English Electric Ltd.

Darlington T.C. Electrical work in new Skerne Pk Primary School, Cox-Walkers Ltd., £1,968.

Durham C.C. Provision of lighting along Pity Me By-pass, Atlas Lighting Ltd., £1,353 15s 3d.

Eccles B.C. Electrical installations in 102 Philip St flats, £3,596, and 90 Egerton St flats, £4,073, E. Soper and Co. Ltd.

Edmonton B.C. Electrical installation in Block C Snells Pk redevelopment, Holmes and Larkinson, £4,678.

Luton B.C. Rewiring of 281 houses Ashcroft Rd estate, J. and J. Burtenshaw and Ptnrs., Ltd., £6,478. Recommended.

Stockton-on-Tees T.C. Electrical installation in Primrose Hill Day School, Cox-Walkers Ltd., £2,586. Recommended.

Whitby U.D.C. Supply and erection of 131 Group "A" columns with 250 W lanterns, General Electric Co. Ltd.

BUSINESS PROSPECTS

Alfreton. New factory is planned for Schoolboy Boot Co., 110 King St.

Andover. B.C. propose redevelopment of 18 acres in central area; purchase of land to cost £1 million.

Armagh. N. Ireland Hospitals Authority, Belfast, plan extensions to City Hospital to include a maternity wing, out-patients' department, boiler house and a nurses' home; architect: W. A. Johnston, 38 Abbey St, Armagh.

Barry. Development to cost £400,000 at Holton Rd proposed by Ravenseft Properties Ltd., Avenfield Hse, 118-127 Park La, W.1.

Basingstoke. Wilkinson Sword Ltd. propose new factory, Houndmills industrial estate. R.D.C. propose 69 dwellings, Cavalier Rd, Basing. Surveyor.

Birmingham. Education Com. proposes three new schools costing £250,000; contractors: Higgs and Hill Ltd., South Lambeth Rd, S.W.8.

Blackwell. R.D.C. propose 26 old people's bungalows, Glapwell. Surveyor.

Bradford. Leeds Regional Hospital Board, Harrogate, plan new nose, throat and eye unit at the Royal Infirmary; estimated cost: £507,579.

Bristol. £10 million hospital development scheme proposed, St. Michael's Hill area.

Campbeltown. B.C. propose housing scheme for 900 people, costing £500,000.

Cardiff. Planned: factory/offices, Wentloog Rd, for "W.A. Foundries," Cardiff.

Carlisle. C.C. propose £260,000 further instalment to Technical College; architects: Buckland and Haywood, Norwich Union Chmbrs, Congreve St, Birmingham.

Cheltenham. B.C. award Geo. Wimpey and Co. Ltd. £152,644 contract for 74 flats, Arle estate.

Chesterfield R.D.C. New £184,000 regional sewage disposal works proposed, Stonebroom. Surveyor.

Chichester C.C. Tender: replacement of pumping machinery, Mill La pumping station. City Engineer.

Christchurch. Proposed first phase of new grammar school, Smugglers La, to cost £157,000; contractors: Chivers and Sons Ltd., Devizes.

Clacton. The N.E. Metropolitan Regional Hospital Board, Eastbourne Terr, W.2, plan new boiler house and plant, Heath Hospital; cost: £70,580.

Coalville. U.D.C. propose new £200,000 sewage treatment works, The Sharrows. Surveyor.

Coventry. Cold store, Barras Heath Market, proposed by Coventry Wholesale Fish Co. Ltd., Barras Heath.

Dalkeith B.C. Tender: 61 houses, Shadepark, Morham and Brochie, 29 Hanover St, Edinburgh 2.

Darlington. T.C. propose Branksome secondary school. Architect.

Dartford. Planned: extensions to factory, 291 Watling St, for Femco Engineering Co.

Doncaster. Industrial and Investment Services Ltd., 129 Finsbury Pavement, E.C.2, plan development in Sunny Bar area to include a 24-lane bowling centre/shops/offices/flats; cost: £100,000. Parker and Roberts, 37 Silver St, Lincoln, architects for proposed £150,000 hotel/motel, Blyth-Nottingham Rd.

Durham. L. E. Price and Son Ltd., Gibson St, Consett, propose six-acre residential development, Crook. Newcastle Regional Hospital Board, Benfield Rd, Newcastle, propose £110,000 triple operating theatre suite and central sterile supplies dept., Dryburn Hospital; Board architect. W. and T. R. Milburn, 4 Grange Terr, Sunderland, architects for proposed C.C. grammar/technical school, Annfield Plain. C.C. propose 26 dwellings, Grape La; architects: Tarron and Caller, 26 Fore St, Sedgefield. Warehouse/offices, Gilesgate Moor, Belmont, proposed for Eldorado Ice Cream Co. Ltd., Stamford St, S.E.1. C.C. propose development of 280 acres, Washington, as industrial estate.

Easington R.D.C. Tender: 19 houses, High Hesleden. Clerk.

Eastleigh. B.C. propose 38 dwellings, Sycamore Rd, Chandler's Ford, and 47 houses, Hiltingbury.

Eccles. Planned: Extensions/alterations, Crescent Ironworks, Shakespeare Cres, for W. Tomlinson and Sons Ltd.

Edinburgh. Restaurant to cost £80,000 proposed at junction of George St and Charlotte Sq for Roxburgh Hotel Ltd., 38 Charlotte Sq.

Enfield B.C. Tender: 34 dwellings, Ferns nursery estate, Engineer.

Falkirk. Planned: £178,000 for first stage development at Callander Riggs for shop premises; promoters: Falkirk Development Co. Ltd., 140 West George St, Glasgow.

Fareham. Hants C.C. propose new county secondary boys' school and extensions to Fareham County Secondary Girls' School. County Architect.

Felling. U.D.C. award £234,000 swimming bath contract, Leam La estate, to Harbour and General Works Ltd., Washington.

Gateshead. T.C. propose new shopping centre, Lobley Hill. Engineer.

Gillingham. Proposed: £100,000 new bakery; architects: H. A. Halpern and Ptnrs., 58-60 Cannon St, E.C.4.

Glasgow. C.C. to re-invite tenders for electrical installation work at Damshot Cres Secondary School.

Greenwich M.B.C. Tender: 112 dwellings, Vanburgh Pk, Blackheath, S.E.3. Chamberlain, Powell and Son, architects, 1 Lamont Rd Passage, S.W.10.

Guildford. B.C. propose 134 houses, Park Barn. Engineer.

Hants. C.C. propose new estate for 40,000, Whitehill, Bordon area. County Planning Officer.

Harrogate. Planned: three 12-storey blocks of 170 flats and 30 maisonnettes, at Park Pl; cost £1,400,000. The Imperial Tobacco Co. Ltd., East St, Bristol 3, plan research centre.

Hastings. Education Committee recommends high school for girls be completed in one final instalment: cost from £110,000 to £120,000. Borough Engineer.

Hornchurch. Plans are in hand for new premises at 137-9 High St; architects: Thompson and Whitehead, 35 Eastern Rd, Romford, Essex.

Huddersfield. The Sheffield Regional Hospital Board, Old Fulwood Rd, Sheffield, propose residential buildings, General Hospital; expected cost: £226,000.

Ipswich C.B.C. Tender: 128 dwellings, Chantry estate. Engineer.

Kelso. New factory proposed for Peter Scott and Co. Ltd., 11 Buccleuch St, Hawick.

Kidderminster. B.C. propose 11-storey flats, six-storey flats and four-storey maisonnettes, Hurcott Rd. Engineer.

Kirkby. U.D.C. propose £150,000 civic centre. Architect.

Lancashire. County Planning Com. to grant application from William Twist and Sons Ltd., Market St, St. Helens, for nearly two acres at Haydock industrial estate for depot.

Lanchester. Factory additions proposed by Bolton Ltd., Castleside, Lanchester; architects: Eltringham and Lowes, Derwent St, Blackhill.

Leeds. Town Centre Securities propose redevelopment of nine-acre site bounded by Merrion St, Woodhouse La, Cobourg St and Wade La; project includes 97 shops, two office blocks (14 storeys and five storeys), a "motel," dance hall: architects: Gillinson and Barnett, 8 Queen Sq; cost: £2 million. C.C. propose rectification scheme and remedial works, Quarry Hill flats; cost: £343,000; H. C. Dowe, City Chmbrs, Infirmary St, consulting engineer.

Lincoln. Diocesan Training College, to cost £120,000; architects: Watkins, Coombes and Ptnrs., 191 High St.

London. St. Pancras B.C. propose replacement of gas-fired water heaters by electric storage heaters on several estates; cost: £21,213. Proposed: development Moorfields to Moor La, including Moorgate Station entrance, for offices/shops; L. Solomon, Kay and Ptnrs., architects, Thavies Inn Hse, Holborn Circus, E.C.1. Planned: 15-storey building with basement car park, Fetter La, West Harding St and 7 Gt. New St; C. E. Wilford and Son, architects, 2 Green St, W.1. The Devonshire Club, St. James's St, W.1, proposed for rebuilding as seven-storey and basement building to include a club, shops, showrooms and offices; architects: Louis de Soissons, Peacock, Hodges and Robertson. Planned: offices/shops, Brent St; architects: Ronald Ward and Ptnrs., 29 Chesham Pl, S.W.1. Development, seven acres for housing, Heath Rise and Kersfield Rd, S.W., proposed by R. Fielding, architect, Aldwych Hse, W.C.2.

Lowestoft. B.C. propose £100,000 swimming pool, Esplanade.

Luton. B.C. propose installation of lift at "The Mount." Engineer.

Manchester. S. Redfern and Co. Ltd., 51 Grosvenor St, Manchester 1, propose factory/offices, Collingham St, Cheetham. Education Committee has placed contract with G. and J. Seddon Ltd., Walkden, for erection of a hostel, Didsbury Training College. Gerrard and Sons Ltd., Swinton, have been awarded £500,000 contract by Humphreys and Glasgow Ltd. for development, Clayton.

Middlesbrough. Premier Dwellings Ltd., 157 Albert Rd, propose multi-storey flats, South Rd, Norton-on-Tees. Proposed: 78 dwellings, Acklam Rd, by same company; architects: Garbutt, Archibald and Archibald, 23 Albert Rd.

Newburn. Warehouse/offices, Newburn trading estate, planned by Goodyear Tyre and Rubber Co. Ltd.; architects: Derek Avery and Assocs., Longwood Hse, Failand, Bristol 8.

Newcastle. Holland & Hannen and Cubitts, Team Valley estate, Gateshead, awarded £300,000 contract for 15-storey office block, Gallowgate. A 180 ft office block at St. Andrew's proposed by Welbar Developments Ltd., to cost £300,000; contractors: Holland & Hannen and Cubitts (Scotland) Ltd., Wallsend-on-Tyne.

New Malden. An 11-storey block of offices with shops on the street level and a basement car park planned; architects: H. A. Halpern and Ptnrs., 58-60 Cannon St, E.C.4; cost: £400,000.

Northern Ireland. New factory, Rathgael, proposed by Dalmas Ltd., 63a Victoria St, Belfast; cost: £350,000; contractors: P. Carvill and Sons Ltd., Warrenpoint, Belfast.

Nottingham. New factory proposed, Bilborough, for Gordonia Mnfg. Co. Ltd., 26 Stoney St, Nottingham.

Oldham C.B.C. Tender: 74 traditional houses, Littlemoor La. Cameron and Middelton, 21 Mumps.

Peterborough. Warwick and Ellis, 43a Priestgate, architects for proposed new county school, Helpston, and extensions to C.E. infants' school, Eye. R.D.C. propose 20 dwellings, Castor and Glinton, and 60 dwellings, cost £157,238, Hodney Rd, Eye. Surveyor.

Plymouth C.C. Tender: 55 dwellings, several areas. City Architect.

Pontypridd. Centrovincial Properties, of London, plan shopping precinct of 36 shops over a car park in the town centre; cost: £330,000: architects: H. A. Halpern and Ptnrs., 58-60 Cannon St, E.C.4.

Poole B.C. Tender: supply and installation pumps and ancillary equipment, Fleets Bridge pumping station. Engineer. T.C. propose new 220-acre estate with 1,320 dwellings, South Canford Heath; cost: £1,060,000.

Portsmouth. C.C. proposes two 18-storey blocks of flats, Church St area, Landport. City Development Officer.

Rutherglen B.C. Tender: 40 non-traditional houses, Fernhill. Surveyor.

Business Prospects—continued

St. Asaph. Industrial Estates Management Corpn. of Wales, Treforest, plan new factory for Ega Electric Ltd., 13 Basinghall St, E.C.2.

St. Ives (Hunts). B.C. propose 40 dwellings. Surveyor: M. W. Fellows, 37 High St, Huntingdon.

Salisbury. C.C. propose 144 dwellings, Friary redevelopment area. City Engineer.

Sheffield. W. G. Robson Ltd., Sheffield, contractors for £250,000 Moorwood-Vulcan Ltd. factory, Harleston St. B.C. propose electrical installation works, Central Technical College; Tinsley Electric Co. Ltd. to prepare scheme.

Southall. Property Investment Condolidation Ltd. have acquired site, Uxbridge Rd, for office building, a central spine 12 storeys high, with two wings, are planned; architect: Theo. Birks, 38 Portland Pl, W.1.

South Shields. T.C. award contract for 107 dwellings, Reading Rd, to W. Veti Ltd., Station Rd, Fulwell.

Spalding R.D.C. Tender: supply and erection of one 100 g.p.m. sludge pump with ancillary equipment, Crowland Wks. J. H. Haiste and Ptnrs., Bridge St, Peterborough.

Spondon. Research laboratory proposed for British Celanese Ltd., Foleshill Rd, Coventry.

Stirling B.C. Tender: 200 traditional houses, Coxithill, Torbrex. Clerk.

Stockport. B.C. award £459,866 contract for second stage of extensions to College of Further Education to Tersons Ltd., Dollis Park, N.3.

Stoke-on-Trent. Multi-storey flats proposed, Bucknall New Rd area; cost: £1¼ million.

Surbiton B.C. Tender: 32 houses, Middleton estate. Town Clerk.

Thetford. Planned: factory for Novobord (U.K.) Ltd., 1a The Parade, Haven Green, W.5; cost: about £1,250,000.

Tickhill U.D.C. Planned: 56 dwellings. Surveyor.

Tonbridge. Kent C.C. propose £76,000 second stage of new building at Hugh Christie Secondary School.

Tynemouth. Additions to works planned, Norham Rd, N. Shields, for Ronson Products Ltd., Leatherhead, Surrey; architects: Tasker and Ptnrs., 25 New Bridge St, Newcastle.

Wallingford. B.C. propose 26 dwellings, Wigwood Way. Surveyor.

Walsall. B.C. propose £715,087 West Midlands Training College.

Wantage. U.D.C. propose 35 dwellings, Ormond Rd. Surveyor.

Washington. Planned: new factory for Tube Investments Ltd., Rocky La, Birmingham 6.

Watford. The North-West Metropolitan Regional Hospital Board, Eastbourne Terr, W.2, propose redevelopment of Shrodells Hospital.

Wellington. R.D.C. propose sewage pumping station, Moorhead.

Weybridge. Contract placed with R. J. Stroud Ltd., Addlestone, Surrey, for extensions at the Ministry of Agriculture, Fisheries and Food.

Wilton. Wilts C.C. propose to rebuild C.E. primary school on present site, West St, and extensions to C.E. modern school; cost: £138,151.

Winchester. C.C. award £395,848 contract for four blocks eight-storey flats, Winnall Manor estate, to Wates Ltd., 1528 London Rd, S.W.16.

Worcester C.C. Tender: 156 dwellings, Warndon estate. Engineer.

Worksop B.C. Tender: 30 houses, Valley Rd estate. Engineer.

Worthing. Proposed: 72 houses and bungalows off Durrington La, for Littlemark Development Ltd.; plans by A. C. Draycott, 8 South St, Lancing, Sussex.

Yeovil. Factory planned for Modern Equipment Co., of Bridgwater, Som.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

W. T. Bingham (Electrical Contractors) Ltd., 847 Chesterfield Rd, Sheffield 8. Nom. cap.: £5,000. Dirs.: Walter T. Bingham and Mrs. Hilda Bingham.

Cook and Ellington Ltd., Aislaby Hse, Thorpe Thewles, County Durham. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £1,000 in £1 shares. Dirs.: Hornby Cook and Joseph N. Ellington.

Coopers Electrical (Plymouth) Ltd., R.O., 4 Grenville Rd, St. Judes, Plymouth. Nom. cap.: £100. Dirs.: Frederick J. Cooper and Doris Cooper.

Domestic Electricals (Colwyn Bay) Ltd., 80 Abergele Rd, Colwyn Bay. Nom. cap.: £1,000. Dirs.: Harold F. Perkins, William Edwards, Myfanwy Perkins and Sheala M. Edwards.

Easymind Ltd., 48 Upper Zoar St, Wolverhampton. Electricians, wireless, electrical and mechanical engineers, etc. Nom. cap.: £102. Dirs.: Peter C. H. Scott-Reed and Mrs. A. Scott-Reed.

Electro Installations (Scotland) Ltd., 54 Old Broad St, E.C.2. Nom. cap.: £100. Dir.: Jack A. Atkins.

Electronic Services (Bray) Ltd., 80 Windsor Rd, Bray, Maidenhead, Berks. To take over the businesses of dealers, installers and suppliers of aerials, electronic cables and electronic and electrical sets and equipment carried on as "W.K. Aerial Installations" and "Electronic Cables (Windsor)" carried on at 80 Windsor Rd, Bray, etc. Nom. cap.: £2,000. Permnt. dirs.: George V. Ward and Mrs Winifred E. Ward.

Elkar (Traction) Ltd., Westcroft Farm, Windlesham Rd, Chobham. Electrical engineers, etc. Nom. cap.: £500. Dirs.: Elizabeth Lady Trefgarne, Rt. Hon. Lord David Garro Trefgarne and The Hon. Trevor Garro Trefgarne.

Ferguson Superheaters Ltd. To carry on the business of civil, mechanical and electrical engineers, etc. Nom. cap.: £20,000. Dirs.: to be appointed by subs. Subs.: Harold L. Layton and Herbert W. Higginson, 62 London Wall, E.C.2.

Allan Goult Ltd., 13 Keswick Rd, Normanby, Middlesbrough. Electrical, radio and general engineers, etc. Nom. cap.: £100. Dirs.: Allan Goult and Mrs. J. R. Goult.

A. and R. Marsh (Electrical) Ltd., The Grange Office, Grange View Rd, Whetstone, N.20. Nom. cap.: £100. Dirs.: Albert W. Marsh and Ruth M. B. Marsh.

Moretone (Unique) Ltd., 83 South Norwood Hill, S.E.25. To acquire land and buildings, etc. Power is taken to construct, equip and carry on works for the manufacture of gas and electricity, etc. Nom. cap.: £3,000. Dir.: Dorothy M. Blackmore.

George H. Samule and Son Ltd., 164-174 Corporation St, Birmingham 4. Importers and exporters, manufacturers and factors of automobile and electrical components, etc. Nom. cap.: £1,000. Dirs.: Joseph E. T. Weaver and George W. Sample.

MEETINGS TO NOTE

SATURDAY, 19 AUG.

THE NEW TV SHOW at New Horticultural Hall, Westminster, until 24 Aug.

WEDNESDAY, 23 AUG.

NATIONAL RADIO AND TELEVISION EXHIBITION at Earls Court until 2 Sept.

MONDAY, 4 SEPT.

FARNBOROUGH FLYING DISPLAY AND EXHIBITION at Royal Aircraft Establishment, Farnborough, until 10 Sept.

WEDNESDAY, 6 SEPT.

I.E.E. (Electronics and Communications). Conference on "Microwave Measurement Techniques," Savoy Pl, W.C.2, until 8 Sept.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aptec. 816,241. Class 9. Apparatus, etc. A.P.T. Electronic Industries Ltd., 42 Bedford Ave, W.C.1.

Axem. 804,916. Class 7 and 804,919. Class 12. Motors, etc. Normacem S.A., 37 rue du Rocher, Paris 8e, France.

Bylock Twinbeater. 804,631. Class 7. Food mixers incorporating double beaters, etc. Bylock Electric Ltd., 109 South St, Ponders End, Middx.

C.I.M.E. in design. B809,792. Class 9. Contacts, counterweights, etc. Compagnie Industrielle des Metaux Electroniques S.A., 8 Rue Cognacq Jay, Paris 8e, France.

Epitherm. 818,574. Class 9. Insulated conductors and cables. A.E.G., 150 Hohenzollerndam, Berlin-Grunewald, Germany.

Epoflex. 818,998. Class 17. Epoxy resin coated glass fibre fabrics, tapes, etc. Ioco Ltd., Netherton Wks, Anniesland, Glasgow W.3.

Galaxy. 810,378. Class 10. Heating pads, etc. A.E.I.-Hotpoint Ltd., 33 Grosvenor Pl, S.W.1.

Gantrade. 819,567. Class 11. Lamps. G. A. H. Andrews, 42a St. Mary's Row, Moseley, Birmingham 13.

Mullard. B813,201. Class 21. And in design. B813,202. Class 21. Glass tubing and rods for use in the construction of lamps, valves and cathode ray tubes, etc. Mullard Ltd., Mullard Hse, Torrington Pl, W.C.1.

O Konvecta-lite. 818,579. Class 11. Lighting apparatus, etc. A.E.I. Lamp and Lighting Co. Ltd., 33 Grosvenor Pl, S.W.1.

Omega. 806,015. Class 9. Heating and ventilating system controls, etc. E. E. Pratt and Ptnrs. Ltd., 76a Malden Rd, New Malden.

Pendaloy. 817,128. Class 11. Pendant lighting fittings, etc. Loblite Ltd., Third Ave, Team Valley, Gateshead-on-Tyne 11.

Spacequeen. 817,866. Class 6. Sinks and sink units incorporating washing and/or drying machines, etc. 817,867. Class 7. Washing and drying machines, etc. Whitewhirl Mnfg. Ltd., 48/58 St. Andrews St, Newcastle.

Sprite. 815,110. Class 9. Arc welding apparatus, etc. Lincoln Electric Co. Ltd., Black Fan Rd, Welwyn Gdn City, Herts.

Staticon. 817,876. Class 17. Insulating material and insulators, etc. Steatite and Porcelain Products Ltd., Imperial Chemical Hse, Millbank, S.W.1.

Sword. 819,184. Class 9. Apparatus, etc. Wilkinson Sword Ltd., 16 Pall Mall, S.W.1.

Thermo-Climatrol. 816,847. Class 11. Air conditioning apparatus, etc. Thermocontrol Installations Co. Ltd., 2/10 Valentine Pl, Blackfriars Rd, S.E.1.

Thermocap. B814,166 and **Thermofit.** B814,167. Class 17. Insulating apparatus, etc. Raychem U.K. Ltd., Highams Pk, E.4.

Titacon. 817,873. Class 9. Apparatus, etc. 817,874. Class 17. Insulating materials, etc. Steatite and Porcelain Products Ltd., Imperial Chemical Hse, Millbank, S.W.1.

Vericon. 817,489. Class 9. Devices for measuring the concentration of solids in liquids, etc. Alto Instruments (Gt. Britain) Ltd., London Rd, Brimscombe, Stroud, Glos.

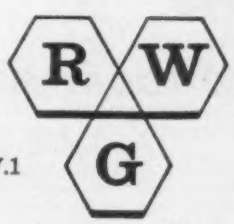
Weldmatic. 814,505. Class 9. Spot welding apparatus, etc. Unitek Corpn., 950 Royal Oaks Drive, Monrovia, California, U.S.A.

ANOTHER ORDER FOR RICHARDSONS WESTGARTH CONDENSING PLANT

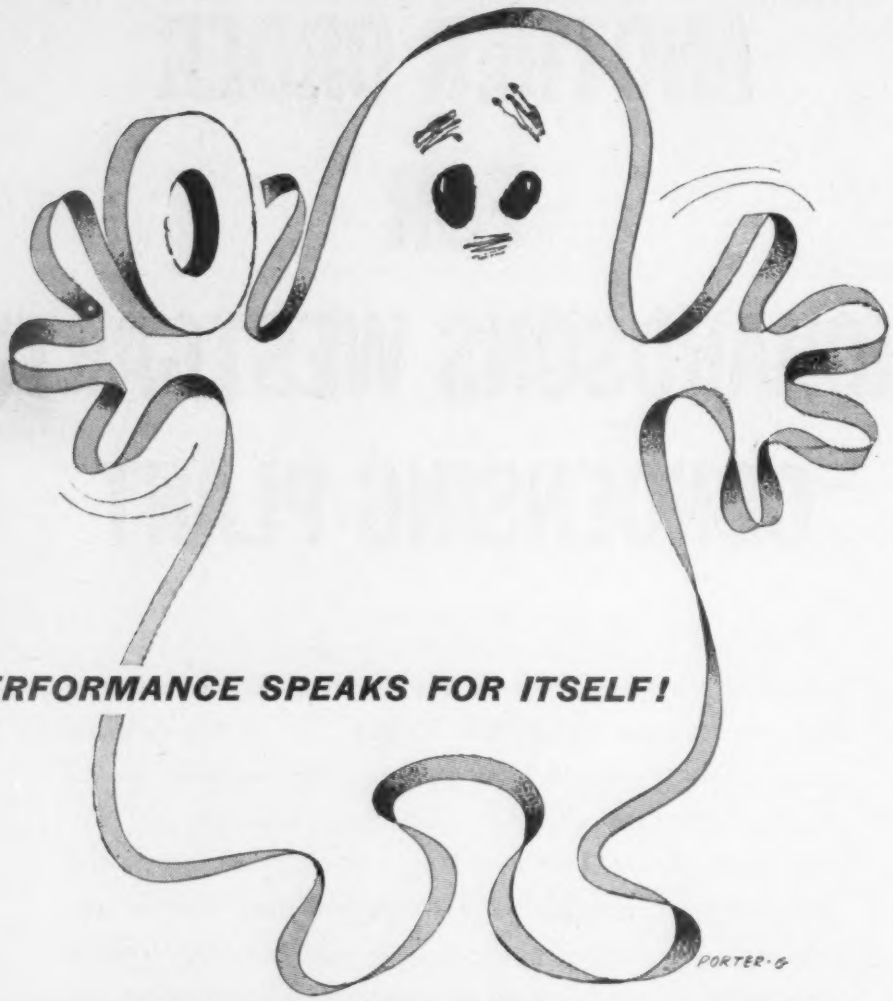
Following the recent order for four complete sets of condensing and feed-heating plant for Tilbury 'B' power station, Richardsons Westgarth have received a further order for the supply of their new design of condensing plant for a 300 MW turbo-generator at West Thurrock power station. As manufacturers of turbo-generators, water tube boilers, blowers and evaporating plant, the Richardsons Westgarth Group have the experience to enable them to accept responsibility for the planning, manufacturing and commissioning of complete power plants.

RICHARDSONS, WESTGARTH & CO. LIMITED.

The Controlling Company of
The RICHARDSONS WESTGARTH GROUP
Wallsend, Northumberland and at 58 Victoria Street, London, S.W.1
59 Mosley Street, Manchester. 75 Buchanan Street, Glasgow.



LASSO No. 92 PVC Electrical Tape can do everything but talk—



ITS PERFORMANCE SPEAKS FOR ITSELF!

Lasso No. 92 has so many properties, so many uses, we could fill this page with them. And dull reading it would make. A lot of stuff about pliability, water resistance, acid resistance, wrapping, jointing, insulating, binding, splicing — *that* sort of thing. Far better send for our alert young representative, *he* makes it sound interesting. Ask your secretary to drop us a line today.

SEND TODAY FOR OUR WALKIN', TALKIN', THINKIN' REP

LASSOTAPES

for all electrical and industrial uses

SMITH & NEPHEW LIMITED · WELWYN GARDEN CITY · HERTFORDSHIRE S&N

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

POYNTON-WITH-WORTH PARISH COUNCIL

TENDERS are invited for the installation of Class "A" Lighting on the trunk road at Poynton, consisting of the provision and erection of 55 concrete columns and sodium lanterns. Forms of tender, specifications, and bills of quantities may be obtained from the Council Offices, where the layout plan may be seen.

Tenders to be submitted to the undersigned in plain sealed envelopes marked "Class 'A' Lighting" by noon on Monday, 18 Sept., 1961.

B 600)

BOROUGH OF UXBRIDGE

TENDERS are invited from electrical contractors who are members of N.I.C.E.C. for work in connection with the undermentioned contracts:

Contract No. 111 150 No. Houses, Hillingdon

Contract No. 112 152 No. Houses, Hillingdon

Contract No. 113 130 No. Houses, Cowley

The work will consist of the re-wiring of existing lighting circuits and the provision of a ring main power circuit with additional points for cooker and immersion heater in each house. Forms of Tender and Specification may be obtained from A. W. Caudery, A.I.HSG., M.R.S.H., Housing Manager, 267 High St, Uxbridge.

Tenders to be returned to the undersigned in the envelope provided, marked "Tender for Contract No. 111/112/113," and bearing no other mark or indication of the sender, not later than 9 a.m. on Monday, 11 Sept. The Council do not bind themselves to accept the lowest or any tender.

E. RONALD WEST,
Town Clerk.

265 High St.
Uxbridge, Middx.

(B 601)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Awe Project

16.5 MVA, 132/11kV, Transformer and Auxiliary Transformer for Nant Power Station

TENDERS are invited for the above Transformers. Tender documents may be obtained from the Engineers: Messrs Strain and Robertson, 5 Park Circus, Glasgow C.3, on receipt of a deposit £2 2s (returnable). The Board do not bind themselves to accept the lowest or any Tender. (B 606)

FLINTSHIRE COUNTY COUNCIL

Queensferry By-pass Lighting

TENDERS are invited for the supply and delivery of pre-cast concrete or steel lighting columns, lanterns, lamps and all fittings, to the site of the road works at Queensferry, Flintshire.

Forms of tender obtained from the County Surveyor, Llwynegrin, Mold, to be returned to me in a plain sealed envelope endorsed "Queensferry Lighting" before 12 noon, Monday, 4 Sept., 1961.

W. HUGH JONES,
Clerk of the County Council.

County Bldgs,
Mold. (B 636)

BOROUGH OF STOCKTON-ON-TEES

Re-lighting of Trunk Road A.19

SEPARATE tenders are invited for the supply only of:

(a) 13 No. Reinforced Concrete Group "A" Lighting Columns.

(b) 13 No. 140 W S.V.D. lamps, lanterns and ancillary equipment.

Forms of tender, conditions of contract and specification may be obtained from Gilbert Cowan, Esq., A.M.I.C.E., Borough Engineer and Surveyor, Municipal Bldgs, Church Rd, Stockton-on-Tees, on payment of a deposit cheque of £2 2s in respect of tender (a) and £2 2s in respect of tender (b).

Applicants should state their requirements of either or both forms of tender and, upon receipt of a bona fide submission, deposits will be returned.

Tenders enclosed in the endorsed envelopes provided must be delivered to the undersigned not later than 12 noon on Friday, 8 Sept., 1961.

JOHN B. HAWORTH,
Town Clerk.

Municipal Bldgs,
Church Rd,
Stockton-on-Tees. (B 630)

BOROUGH OF MORLEY

Street Lighting Department

Trunk Road Lighting—A.62

TENDERS are invited for the supply, installation and putting into service of 52 totally enclosed 140 W sodium street lighting units on 25 ft concrete columns on the above road; 22 of these columns must each be capable of supporting a pair of overhead feed wires.

Forms of tender may be obtained from the Public Lighting Engineer, Town Hall, Morley, and must be returned to the undersigned, endorsed Street Lighting Tender, not later than Saturday, 16 Sept., 1961.

E. V. FINNIGAN,
Town Clerk.

Town Hall,
Morley,
Yorkshire. (B 628)

BOROUGH OF NEWCASTLE-UNDER-LYME

Conversion of Group "A" Street Lighting North of Newcastle-under-Lyme–Nantwich–Tarporley–Tarvin Trunk Road A.52

TENDERS are invited for the supply, delivery and installation of 35 No. 200 W sodium vapour Group "A" lighting units, including conversion fitting for existing steel columns, 200 W sodium lanterns, lamps and ancillary equipment.

Plans may be inspected and tender documents obtained from the Borough Engineer, Lancaster Bldg, High St, Newcastle, Staffs.

Tenders must be returned to the undersigned in the envelope provided and endorsed "Tender for Group 'A' Lighting, Trunk Road A.52" to be received not later than noon on Monday, 11 Sept., 1961.

The lowest or any tender will not necessarily be accepted.

C. J. MORTON,
Town Clerk.

(B 629)

BOROUGH OF CHATHAM

Street Lighting Programme

Conversion Scheme Gas to Electricity

TENDERS are invited for the supply and erection of approximately 1,080 Class "B" street lighting units within the Borough Boundaries. The columns and lanterns are to be obtained from already approved nominated suppliers and the contract will include the supply of columns, lanterns and control gear, the erection and wiring of all the equipment, together with the permanent reinstatement of all carriageways and footways and all ancillary works.

The Form of Tender, General and Special Conditions of Contract, Specification and Bill of Quantities may be obtained from, and the drawings inspected at, the office of Mr J. A. T. Richards, Borough Engineer and Surveyor, Town Hall, Chatham, on payment of a deposit of £2 2s, which will be refunded on receipt of a bona fide tender or the return of all issued documents before the closing date for receipt of tenders.

Tenders must be delivered in accordance with the Conditions of Tender to the undersigned not later than 12 noon on Monday, 4 Sept., 1961.

The Council do not bind themselves to accept the lowest or any tender.

ROWLAND NEWNES,
Town Clerk.

Town Hall,
Chatham. (B 556)

COUNTY BOROUGH OF SUNDERLAND

TENDERS are invited for Electrical Installations to the following:

(a) Sunderland Training College Extensions

(b) Hylton Red House Community Centre

Tender documents obtainable from Borough Architect, Grange Hse, Stockton Rd, Sunderland. Applicants please specify which required.

Sealed tenders, properly endorsed, must be received at my office, Town Hall, not later than 14 Sept., 1961.

G. S. McINTIRE,
Town Clerk.

(B 614

APPOINTMENTS VACANT

MIDLANDS ELECTRICITY BOARD

APPOINTMENT OF CHIEF ENGINEER

APPLICATIONS are invited for the post of Chief Engineer to succeed Mr. G. S. Buckingham, B.SC., M.I.E.E., on his appointment as Deputy Chairman of the Board. The successful applicant will be expected to take up the appointment on 1 Dec., 1961.

Candidates must be Corporate Members of the Institution of Electrical Engineers and should have had wide experience in a large electricity supply organisation.

The salary will be between £4,000 and £4,750 per annum.

Applications, giving full details of age, qualifications, experience, present salary and position, should be forwarded to the Chairman of the Board at Mucklow Hill, Halesowen, nr. Birmingham, to arrive not later than 8 Sept., 1961. (B 615)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate Vacancy Number.

Ilkeston and North Derbyshire Sub-Area:

SECOND ASSISTANT ENGINEER

(TECHNICAL AND SUBSTATIONS)

Vacancy No. 94/61.

Salary: N.J.B. Class K, Grade 7, £1,350/£1,500 per annum.

The duties will include assisting in protective systems, fault location, commissioning and testing of transformers, switchgear and other apparatus.

Applicants should possess the Higher National Certificate in Electrical Engineering or an equivalent qualification and should be familiar with the installation of electrical plant including transformers, switchgear, etc., and all ancillary equipment up to and including 66 kV and should be able to interpret and check switchgear and manufacturers' drawings.

Applications should be forwarded to the Manager, Ilkeston and North Derbyshire Sub-Area, 1 Derby Rd, Ilkeston, Derbyshire, by 8 Sept., 1961.

[illegible]ire Sub-Area

DEMONSTRATOR, BOSTON DISTRICT

Vacancy No. 95/61.

Salary: N.J.C. Grade 1, £600 x £25—£700 per annum.

The duties will include conducting demonstrations in Service Centres, general duties including sales and advice to consumers on the selection and use of electrical appliances both at the Service Centre and on consumers' premises.

Applicants must be over 21 years of age and should hold the E.A.W. Electrical Housecraft Certificate.

Ability to drive a motor vehicle is desirable.

Applications should be forwarded to the Manager, Lincolnshire Sub-Area, North Hse, Grantham, Lincolnshire, by 8 Sept., 1961.

Northamptonshire Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER

BLETCHLEY DISTRICT

Vacancy No. 96/61.

Salary: N.J.B. Class F, Grade 7, £1,040/£1,165 per annum.

The duties will include assisting in the operation, maintenance, planning and construction of rural and urban networks up to and including 11 kV.

Ability to drive a car is essential. The successful applicant will be required to reside within the District and to undertake standby duties.

Applications should be forwarded to the Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, by 8 Sept., 1961.

Nottingham Sub-Area

FOURTH ASSISTANT DISTRICT ENGINEER

Vacancy No. 97/61.

Salary: N.J.B. Class G, Grade 13, £715/£805 per annum.

The duties will include assisting in the operation, maintenance, planning and construction of networks up to and including 11 kV.

The successful applicant must live in or near to Nottingham.

Applications should be forwarded to the Manager, Nottingham Sub-Area, 35-39 Carrington St, Nottingham, by 8 Sept., 1961.

Mansfield and North Nottinghamshire Sub-Area

GENERAL ASSISTANT ENGINEER

Vacancy No. 98/61.

Salary: N.J.B. Class L, Grade 14, £890/£1,015 per annum.

The duties will include assisting in the planning and preparation of schemes and

continued in next column

continued from previous column

specifications for the extension and reinforcement of overhead and underground distribution systems up to and including 11 kV, and the design and layout of substations.

Applications should be forwarded to the Manager, Mansfield and North Nottinghamshire Sub-Area, Lime Tree Pl, Mansfield, Nottinghamshire, by 8 Sept., 1961.

Derby and Burton Sub-Area

THIRD ASSISTANT COMMERCIAL ENGINEER

Vacancy No. 99/61.

Salary: N.J.B. Class K, Grade 9, £1,190/£1,325 per annum.

The duties will include assisting in the development of supply, utilisation, negotiations with consumers and assisting in the activities of the Sub-Area Commercial Department.

Applications should be addressed to the Manager, Derby and Burton Sub-Area, Electricity Offices, Irongate, Derby, in an envelope endorsed "Confidential—Third Assistant Commercial Engineer," by 8 Sept., 1961. (B 573)

MIDLANDS ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER

REQUIRED in the Cannock District of the Wolverhampton Area.

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable.

Salary: £890/£1,015 per annum (N.J.B. Grade F.9). Superannuable.

Apply, by letter, within 14 days, stating age, experience, present position and salary, to Mr D. Holt, Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

F. W. CATER,
Secretary.
(B 604)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

REGIONAL RESEARCH AND DEVELOPMENT DEPARTMENT

TRANSMISSION SECTION HEAD

APPLICATIONS are invited for the position of Transmission Section Head in the Electrical Branch of the above Department located at West Farm Pl, Chalk La, Cockfosters, Barnet, Herts.

The successful candidate will be required to lead a team on research and development work entailing a reasonable amount of field work on overhead lines, underground cables, switching and transforming stations and associated equipment. In addition, he is responsible for a Specialist Engineer engaged on cathodic protection and buried corrosion.

Applicants should have a sound technical training with experience in electrical power system work. A recognised electrical engineering qualification leading to Corporate Membership of the Institution of Electrical Engineers is essential and a University Degree would be an advantage.

The salary, inclusive of London Allowance depending on experience, is within the range of £1,500/£2,145 per annum in accordance with Class L, Grade 3/4/5 of Schedule A of the National Joint Board Agreement.

Applications stating age, qualifications, experience, etc., should be addressed to the Regional Secretary, Ergon Hse, Horseferry Rd, London S.W.1, so as to arrive by not later than 1 Sept., 1961. (B 598)

AIR MINISTRY

REQUIRE Main Grade and Basic Grade

MECHANICAL AND

ELECTRICAL ENGINEERS

for design, construction and maintenance of installations on (a) airfields, radar stations, missile bases, workshops and maintenance units for the R.A.F. at home and overseas; and (b) certain Civil Airports.

SALARY according to age, quals. and exp., ranges for Main Grade Engineers from £1,456/£1,950 (max.) and for Basic Grade from £936 (at 25) to £1,430 (max.), with an increase for London and slight decrease in country districts. In addition, basic grade salary is increased by £95 p.a. (within the maximum of the scale) after two years' approved service, subject to being corporate member of Institution of Mechanical or Electrical Engineers. Appointments long term with good prospects of pension and advancement to numerous posts in higher grades, viz.:

Main Grade Mechanical and Electrical Engineers, £1,456/£1,950—125 posts;

Senior Mechanical and Electrical Engineers, £2,080/£2,392—34 posts;

Superintending Mechanical and Electrical Engineers, £2,650 upwards—9 posts.

Vacancies occurring in these higher grades are, as a rule, filled by promotion of existing staff.

Good opportunities for acquiring experience overseas, where special allowances ranging at present up to £1,800 p.a. according to location and marital status, are payable in addition to a higher salary. Five-day week with four weeks' two days' paid leave p.a. initially.

QUALS.: (a) Graduate (for Basic Grade) or corporate (for Main Grade) membership of I.E.E. or I.Mech.E. (with appreciable electrical engineering experience) with at least three years' apprenticeship; or

(b) University degree (honours for Main Grade) or equivalent diploma in electrical and/or mechanical engineering with at least two years' apprenticeship.

In addition, all candidates should have been employed for minimum of two years with well established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects and, for basic grade posts, between ages 25 and 35. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D.128/1A. Selection will be by interview in London and certain expenses will be reimbursed. (B 428)

COUNTY BOROUGH OF OLDHAM

Lighting Department

TECHNICAL ASSISTANT—STREET LIGHTING

APPLICATIONS are invited from suitably qualified persons for the above appointment which is superannuable.

The salary is within the Grade of APT II (£815/£960 per annum) and a five-day week is in operation.

Applicants should have a sound knowledge of all aspects of lighting, particularly street lighting.

They should possess the Ordinary National Certificate in Electrical Engineering and should hold or be studying for the Intermediate Certificate of the City and Guilds of London Institute in Illuminating Engineering.

Some form of membership of the Association of Public Lighting Engineers will be an advantage.

Further particulars and application form can be obtained from the Superintendent, Corporation Lighting Department, Gas St, Oldham, with whom applications, giving the names of two referees, should be lodged on or before 11 Sept., 1961.

Canvassing will be a disqualification.

EDWARD HAINES,
Town Clerk.

3 Aug., 1961. (B 596)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

North Thames Division

APPLICATIONS are invited for the following appointment in the Electrical Department at Divisional Headquarters—Cockfosters (North London).

THIRD ASSISTANT ENGINEER

(METERING)

(S.V. No. 1459)

Salary: N.J.B. Class AX, Grade 8, Scale 10, £1,105/£1,325 per annum, plus London Weighting £50 per annum.

The duties of the successful applicant will be to assist in the general duties of the Metering Section and in the design of, and the preparation and details for the specifications for new bulk supply and operational metering equipments.

In addition to assist in the preparatory and associated duties in connection with individual and general modifications to existing metering equipments and in the installation and testing of new and special electrical measuring devices.

Applicants should have the Higher National Certificate in Electrical Engineering or equivalent qualifications, and should have practical experience with bulk supply metering equipments using electro-mechanical summation.

Applications, quoting the appropriate Reference S.V. No. 1459, stating age, qualifications, experience and present position, should be sent to the Personnel Officer, Central Electricity Generating Board, North Thames Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 2 Sept., 1961. (B 593)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

THIRD ASSISTANT DISTRICT ENGINEER

(LANARK DISTRICT)

APPLICATIONS are invited for the above appointment.

Applicants should have experience in the operation and maintenance of H.V. and L.V. distribution systems and be conversant with Load Flow Diagrams and Voltage Drop Calculations.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, the present classification and Grading being E.9 (Scale 5) £825/£940 per annum. The position is superannuable.

Application forms, which can be obtained from the Area Manager, Montrose Cres, Hamilton, should be returned to this office within 14 days from the date of this advertisement. (B 608)

BRITISH OVERSEAS AIRWAYS CORPORATION

invite applications from

QUALIFIED ELECTRICAL AND/OR MECHANICAL ENGINEERS

for positions in their Properties and Services Branch at London Airport.

Appointments are immediately available for two Engineers who wish to work with a progressive and expanding organisation on a variety of interesting work.

Salary range: £1,287 10s/£1,627 10s per annum.

The successful applicants will be responsible for all works associated with the installation of and alterations to industrial power, lighting, heating and ventilation and air conditioning schemes.

Application forms will be sent to suitable candidates who should apply in the first instance giving brief details to:

The Recruitment Manager,
B.O.A.C.,
London Airport,
Hounslow, Middlesex.

(B 611)

ELECTRICAL ENGINEER

Junior Designer of D.C. and A.C. electrical machines required. H.N.C. or equivalent. Aged 23 to 27 years. Salary according to experience. Full details of qualifications and experience should be sent to the General Manager, Newton Bros. (Derby) Ltd., Alfreton Rd, Derby. (B 639)

THE NORTH EASTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER

APPLICATIONS are invited from suitably qualified engineers for the above appointment in the Chief Engineer's Department, Technical Section, at the Board's Headquarters, Carliol Hse, Newcastle upon Tyne. Applicants should be experienced in all aspects of work connected with system protection, including fault flow calculations.

Salary: Class K, within Grades 7-8, £1,145/£1,500 per annum, according to qualifications and experience. N.J.B. conditions of service.

Applications in writing, stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (B 620)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

APPOINTMENT OF

THIRD ASSISTANT ENGINEER

STEAM TESTING DEPARTMENT, DUNSTON

APPLICATIONS are invited to fill a vacancy for a Third Assistant Engineer in the Plant Performance Testing Section, based at Dunston on Tyne.

Candidates should have the technical qualificatitons for admission to Associate Membership of a recognised Institution.

Experience of operation, testing, design, or experimental development of modern high pressure steam plant is required.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Grade 8, Class J (£1,105/£1,325 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 25 Aug., 1961 (B 612)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

ASSISTANT MAINTENANCE ENGINEER

(MECHANICAL)

REQUIRED at Ironbridge Power Station, Buildwas, Salop. N.J.B. service conditions, superannuable appointment, salary within Grade J7, £1,275/£1,410 per annum.

Applicants should have served an apprenticeship and possession of technical qualifications of H.N.C. level or leading to Corporate Membership of a major engineering institution would be an advantage. Applicants should preferably have experience of mechanical maintenance at a modern power station.

Apply, quoting Vacancy No. 205/61 MD on form AE6 available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to whom they should be returned by 25 Aug., 1961. (B 581)

KAMPALA MUNICIPAL COUNCIL

Uganda, East Africa

WORKS SUPERVISOR (ELECTRICAL)

REQUIRED in Scale £1,143/£1,671, plus 6% gratuity on completion of contract of 21-27 months; four months' paid leave and air passages for officer and family after two years; Provident Fund (adds 7½% to salary); housing at nominal rent; medical and dental benefits; car loan and allowances; good climate and conditions.

Applicants must have served a five-year apprenticeship with a recognised electrical undertaking or company and hold the Ordinary National Certificate (Electrical) or equivalent qualifications. Works training and experience in maintenance and repair of S.C.E. and/or A.T.E. vehicular actuated traffic signals essential.

The duties envisaged are:

(a) Principally on the installation and maintenance of the vehicular actuated traffic signals: half time.

(b) On the maintenance and repair of electrical systems of automotive plant: one-sixth.

(c) On the installation and repair of electrical installations in private houses, buildings, workshops, etc., including apparatus: one-sixth.

(d) On the installations, maintenance and repair of electrical [illegible] pumps, varying from fractional hor[illegible]-power up to 65 h.p. nominal rating: one-sixth.

All applicants must be fully conversant with the I.E.E. Regulations covering electrical equipment in buildings.

Apply, giving age and two referees, to the Town Clerk, P.O. Box 210, Kampala, Uganda, by 31 Aug., 1961. Canvassing disqualifies. (B 597)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER

(MAINTENANCE AND OPERATION)

NEWBURY District of No. 2 (Newbury) Sub-Area. Salary: N.J.B. Class G, Grade 11 (£825/£940 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. Applicants should possess suitable technical qualifications.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, and returned to him, quoting Z.1390, not later than 28 Aug., 1961. (B 619)

JAMAICA

INSTRUMENT SUPERVISOR

Applications for the above position are invited from qualified electrical engineers familiar with instrumentation preferably in chemical plants.

Attractive salary, pension plan, good housing on rental basis, overseas leave every three years with return travelling expenses paid.

Please give full details of qualifications and experience and ages of children (if any) to Box G.242, c/o Streets, 110 Old Broad St, London E.C.2. (B 610)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a

THIRD ASSISTANT ENGINEER

in the Contracting Section of the Chief Commercial Officer's Department at Board Head Office.

Candidates should, preferably, possess a Higher National Certificate in electrical engineering, have had a sound theoretical training and some practical experience in general electrical installation practice in industrial, commercial and domestic premises. The successful applicant will be required to assist generally in the planning and progressing of electrical installation contracts.

Salary: N.J.B. Class K, Grade 8, £1,145/£1,410 per annum.

Applications on the standard form, quoting Reference C12/61, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 1 Sept., 1961. (B 618)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

ASSISTANT MAINTENANCE ENGINEER

(MECHANICAL)

NORTH WILFORD POWER STATION

Vacancy No. 181/61.

APPLICATIONS are invited for the post of Assistant Maintenance Engineer (Mechanical) at North Wilford Power Station, Queens Drive, Nottingham.

Applicants should be suitably qualified and have received a sound technical training with practical experience in the maintenance of power station mechanical plant.

Preference will be given to candidates who are associated members of a recognised institution or possess similar qualifications.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 25 Aug., 1961.

ASSISTANT MAINTENANCE ENGINEER

(ELECTRICAL)

NORTH WILFORD POWER STATION

Vacancy No. 182/61.

Applications are invited for the post of Assistant Maintenance Engineer (Electrical) at North Wilford Power Station, Queens Drive, Nottingham.

Applicants should have received a thorough technical and practical training followed by considerable experience in testing and protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who are associated members of a recognised institution or who possess similar qualifications.

Salary will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 25 Aug., 1961.

ASSISTANT ENGINEER (OPERATION)

HIGH MARNHAM POWER STATION

Vacancy No. 184/61.

Applications are invited for the position of Assistant Engineer (Operation) at High Marnham Power Station, near Newark, Notts.

Applicants should have experience of the operation and control of modern high pressure boiler and turbine plant, and should posses a H.N.C. in mechanical or electrical engineering, but consideration will be given to those holders of a lower technical qualification who have sound operating experience.

Salary will be in accordance with Class N, Grade 10 (£1,350/£1,500 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

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Closing date for receipt of applications: 25 Aug., 1961.

GENERAL ASSISTANT ENGINEER

(MECHANICAL MAINTENANCE)

DRAKELOW "A" AND "B" POWER STATIONS

Vacancy No. 189/61.

Applications are invited for the position of General Assistant Engineer (Mechanical Maintenance) at Drakelow "A" and "B" Power Stations, near Burton-on-Trent.

Preference will be given to candidates who hold the Higher National Certificates or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class M, Grade 16 (£825/£940 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 1 Sept., 1961.

ASSISTANT PLANNING ENGINEER

WILLINGTON "A" AND "B" POWER STATIONS

Vacancy No. 190/61.

Applications are invited for the position of Assistant Planning Engineer at Willington "A" and "B" Power Stations, P.O. Box No. 27, Derby.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 1 Sept., 1961.

ASSISTANT EFFICIENCY ENGINEER

DRAKELOW "A" AND "B" POWER STATIONS

Vacancy No. 191/61.

Applications are invited for the position of Assistant Efficiency Engineer at Drakelow "A" and "B" Power Stations, near Burton-on-Trent.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 1 Sept., 1961.

SHIFT CHARGE ENGINEER

WARWICK POWER STATION

Vacancy No. 192/61.

Applications are invited from qualified engineers for the position of Shift Charge Engineer at Warwick Power Station, Emscote Rd, Warwick.

Applicants should have had experience in the operation of steam turbine and boiler plant.

Salary will be in accordance with Class E, Grade 7 (£965/£1,090 per annum) of the National Joint Board Agreement plus 10% allowance for shift duties.

Closing date for receipt of applications: 1 Sept., 1961.

GENERAL ASSISTANT ENGINEER

(ELECTRICAL MAINTENANCE)

WILLINGTON "A" AND "B" POWER STATIONS

Vacancy No. 194/61.

Applications are invited from suitably qualified engineers for the position of General Assistant Engineer in the Electrical

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continued from previous column

Maintenance Department at Willington "A" and "B" Power Stations, P.O. Box No. 27, Derby, which is one of the largest power station groups in Europe. The successful applicant will receive training in all aspects of electrical maintenance and be expected to play a full part in the routine work of the Department.

The salary will be within Class M, Grade 16 (£825/£940 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 1 Sept., 1961.

These positions are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

FOURTH ASSISTANT ENGINEERS (TESTING)

DIVISIONAL HEADQUARTERS

NOTTINGHAM

Vacancy No. 193/61.

Applications are invited for the positions of Fourth Assistant Engineers (Testing) at Divisional Headquarters, Nottingham.

Applicants should have received a thorough engineering and technical training and preferably experience in operating and testing modern high performance steam generating plant, or in the field of non-destructive testing of materials.

The salary will be in accordance with Class L, Grade 11 (£920/£1,245 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 1 Sept., 1961.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Administrative Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box No. 25, Barker Gate, Nottingham, and returned to him by the date stated.

O. S. WOODS,
Assistant Regional Director.
(B 617)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

SECOND AND THIRD ASSISTANT ENGINEERS (PROGRAMMES)

APPLICATIONS are invited for appointments of Second and Third Assistant Engineers in the Programmes Department of the Midlands Project Group.

The selected candidates will be required to assist in the preparation of detailed programme charts for complete power station projects.

Candidates should preferably be corporate members of one of the recognised professional institutes and have served an engineering apprenticeship. Experience in the construction of heavy plant as installed in modern power stations either in a manufacturer's works or on site is essential and a knowledge of civil engineering works involved would be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Scale 15, £1,460/£1,830 per annum, for the Second Assistant Engineer, and Scale 13, £1,320/£1,610 per annum, for the Third Assistant Engineer.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, 341 Bournville La, Birmingham 30, and should be returned to him not later than 28 Aug., 1961.

Envelopes should be marked "Confidential—Staff Vacancy No. MPG.54/61."
(B 621)

FOREMAN ARMATURE WINDER

required to take charge of Winding Department. Excellent prospects. Assistance with housing, transport, etc.

Shoolbred Electrical Co. Ltd.,
1 Langley St, Luton.
Telephone: Luton 2930.

(B 592)

DESIGNER DRAUGHTSMAN

for Transformer Drawing Office. Preference will be given to men possessing experience of large power Transformers.

Salary up to £1,075 per annum commensurate with age, experience and qualifications.

Apply in first instance quoting personal details to Personnel Manager, Fuller Electric Ltd., Fulbourne Rd, Walthamstow, London E.17.

(B 632)

J. & P.

require a

SUPERINTENDENT FOR TRANSFORMER FACTORY

An interesting opportunity exists at our Charlton Transformer Factory for a man experienced in the manufacture of transformers and with some knowledge of factory management. As Superintendent of a works producing transformers up to 45 MVA, 132 kV, the successful applicant will join the company at a time when improved production facilities are coming into operation and will be encouraged to develop modern production techniques.

The company offers good holiday and sick pay conditions and operates a superannuation scheme. Applications, which will be treated in confidence, should give details of qualifications, experience, age and present salary, and be addressed to the Employment Manager, Johnson and Phillips Ltd., Charlton, London S.E.7. (B 635)

ELECTRICAL ENGINEERS

Steel, Peech and Tozer, a branch of the United Steel Companies Ltd., have vacancies on their staff for qualified Electrical Engineers to assist in their extensive development programme.

HIGH VOLTAGE ENGINEER (SENIOR APPPOINTMENT)

Applicants should have had a sound training and experience in the construction, operation and maintenance of H.V. switchgear, transformers and underground works distribution systems.

The successful candidate will assist in the preparation of specifications for oil immersed and air blast switchgear up to 33 kV, cabling and associated equipment, and will be directly responsible to the Chief Electrical Engineer for safety operating procedures and for all future maintenance of H.T. equipment used for arc furnace and rolling mill applications.

Qualification: A.M.I.E.E. or equivalent. Commence duties: January, 1962, or earlier.

ASSISTANT ENGINEER (NEW CONSTRUCTION)

Applicants should possess sound knowledge and experience of all types of industrial a.c. and d.c. motors, control gear and cabling installations. Experience with contactor control gear and with the latest control techniques, including electronics, would be an advantage.

The successful candidate will be responsible to the New Construction Engineer (Electrical) for the supervision of site installation work, testing and commissioning of new equipment.

Minimum qualification: H.N.C. in Electrical Engineering (Grad. I.E.E. preferred) and age 25-35. Commence duties: September, 1961, or as soon as possible.

Salaries will be determined by qualifications, age and experience. The appointments will be permanent and pensionable.

Applications should be made in writing to The Labour Manager, Steel, Peech and Tozer, The Ickles, Rotherham, Yorks. (B 566)

THE PUBLIC SERVICE OF PAPUA AND NEW GUINEA

Electrical Undertakings Branch

ELECTRICAL ENGINEER Grade 2 (Design)

£A2,011/£A2,231 p.a. (single)
£A2,161/£A2,381 p.a. (married)

QUALIFICATIONS: Degree or diploma in electrical engineering or qualified for admission to a recognised institute or equivalent professional qualification; technical background in mathematical treatment of design problems.

DUTIES: Survey system load growth and assess future plant requirements; investigate system conditions; prepare designs, specifications, estimates and drawings for lines, substations and generating plant.

SALARY: Rates quoted are actual and include cost of living adjustment and allowance (totalling £A533 p.a. married and £A383 p.a. single). Additional allowances are payable after five and seven years' service. In addition the rates of salary may be subject to adjustment as a result of a recent Arbitration decision.

TAXATION: Income tax is less than half that payable in the United Kingdom for the same taxable income.

ELIGIBILITY: Adult British subject under 45 years.

APPOINTMENT: Permanent on probation.

LOCATION: The Territory of Papua and New Guinea comprises the eastern half of the main island of New Guinea and adjacent islands lying north east of Australia towards the equator. Appointees would be stationed at the largest town, Port Moresby (approximately 1,800 miles by air from Sydney), but may be required to serve anywhere in Territory.

ACCOMMODATION: Single quarters available; married accommodation unlikely to be available under 18 months from date of appointment.

SEPARATION ALLOWANCE: Payable at discretion of Territory Administration; designed to compensate for added expense of married appointees obliged to maintain family outside Territory.

CHILD ALLOWANCE: For first dependent child under 16 years—£A52 p.a. For subsequent dependent children under 16 years—£A65 p.a. All officers receiving adult male rates of salary are required to contribute £A26 p.a. towards cost of allowance.

LEAVE: Three months on full pay after each 21 months in Territory. Additional three months' leave after each six years. Six months' furlough after 20 years.

FARES: On Appointment: The fares of the appointee and wife and dependent children under 16 will be paid from place of residence overseas to the Territory, but movement of wife and family beyond Sydney (Australia) would not be permitted until married accommodation is available in Territory.
On Leave: Return fares will be paid each two years for appointee and wife and dependent children under 16, when proceeding on approved recreation leave, from Territory to Sydney (Australia) or *pro rata* to other places: subject to contribution by officer of £A12 10s single, £A15 married.

FURTHER INFORMATION: Further particulars, an information handbook on the Territory and its Public Service and a statement on taxation are available from the Recruitment Officer, Staff Branch, Australia House, Strand, London W.C.2, or the Department of Territories, Canberra, Australia.

APPLICATIONS: Submit on application form available from above offices quoting ADVERTISEMENT NO. 18, to: The Secretary, Department of Territories, Canberra, A.C.T., AUSTRALIA, by 30 Sept., 1961.

(B 605)

SOUTH WALES SWITCHGEAR LTD.

require a

SENIOR SALES REPRESENTATIVE

to cover the Area of the Eastern Electricity Board. The successful applicant should be experienced in the switchgear and transformer industry. This appointment offers excellent opportunities for promotion in a progressive Company. Please reply to the General Manager, South Wales Switchgear Ltd., Blackwood, Monmouthshire. (B 638)

CROMPTON PARKINSON (CHELMSFORD) LTD.

require a

CHIEF OF ROTATING MACHINE TEST

The Company manufactures Industrial a.c. Motors/Generators up to 4,000 h.p./kVA; Industrial d.c. Motors/Generators up to 1,500 h.p./kW; and Traction d.c. Motors/Generators up to the largest sizes. The applicant is to be responsible for the testing of the whole of this equipment. Apply in confidence, giving particulars of age, experience and qualifications to Personnel Officer, Crompton Parkinson (Chelmsford) Ltd., Writtle Rd, Chelmsford.

(B 591)

THE SOUTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT

APPLICATIONS are invited for the position of Commercial Assistant in the South Cardiganshire District, based at Lampeter, of the West Wales Area.

Preference will be given to Engineers possessing the Higher National Certificate in electrical engineering.

Salary: N.J.B. Class E, Grade 9, Scale 5 (£825/£940 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to E. Broughton, A.M.I.E.E., Manager, West Wales Area, South Beach Pavilion, Tenby, Pembs, to arrive not later than 2 Sept., 1961.

Please quote Reference 56/61/ET, endorsing envelope "Commercial Assistant."

R. G. WILLIAMS,
Secretary.
(B 622)

YORKSHIRE ELECTRICITY BOARD

Head Office

CHIEF ENGINEER'S DEPARTMENT

SECOND ASSISTANT ENGINEER

(OPERATION)

APPLICANTS should have experience in the operation of a large interconnected distribution system, knowledge of the plant and equipment comprising such systems is essential.

The successful candidate will be required to assist in the determination of system operation policy, the administration of regional control centres, and the evaluation of system performance.

SECOND ASSISTANT ENGINEER

(MEASUREMENTS)

Applicants should have experience of modern protective gear systems and metering practice on an extensive distribution system. A knowledge of electronics, telemetering and communication systems is desirable.

The successful candidate will be required to investigate protective gear and metering problems and evaluate protective gear performance. In addition he will be required to participate in research projects undertaken by the Board.

Salary for both these posts is within the range of £1,415/£1,720 per annum (N.J.B. BX5, transistional to Scale 14), the commencing salary being dependent upon qualifications and experience.

Chief Commercial Officer's Department

GENERAL ASSISTANT ENGINEER

(COMMERCIAL)

A vacancy exists in the Tariffs and Statistics Section for an assistant who will deal mainly with utilisation research within the area. This work entails the collection and anlysis of sample survey data. In addition, the assistant will do other work involving report writing and lengthy calculations, therefore some proficiency in mathematics and English is desirable. The successful applicant should be able to work accurately and with concentration.

Salary: N.J.B. Class BX, Grade 13, within the range £770/£1,015 per annum (transistional to Scale 6).

Applications, together with the names of two referees, should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than 1 Sept., 1961.

No. 5 (Wakefield) Sub-Area

WAKEFIELD DISTRICT

FIRST ASSISTANT DISTRICT ENGINEER

Applicants should be experienced in electricity supply, particularly in District organisation.

Experience in the operation, maintenance and construction of substations and mains, both overhead and underground, and in the planning and estimating of development schemes on an electricity distribution system with voltages up to 66 kV will be an advantage.

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Salary: N.J.B. Class H. Grade 5 (Scale 12), £1,350/£1,500 per annum.

This advertisement cancels the one which appeared in last week's issue.

S.A.H.Q.

THIRD ASSISTANT ENGINEER

(METERS, TESTING AND PROTECTION)

Applicants should have had experience in the testing, commissioning and maintenance of protective gear, the location of h.v. cable faults and the testing and installation of metering equipment. The successful applicant will ultimately be required to undertake standby duties.

Salary: N.J.B. Class L, Grade 10 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 1 Sept., 1961.

No. 3 (Sheffield) Sub-Area

FOURTH ASSISTANT ENGINEER

(PROTECTION)

Applicants should have had experience in the testing and commissioning of electrical plant, preferably including protective gear.

Salary: N.J.B. Class N. Grade 13 (Scale 9), £1,115/£1,245 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 1 Sept., 1961. (B 627)

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT MANAGER

CENTRAL SUSSEX DISTRICT

APPLICATIONS are invited for the appointment of Central Sussex District Manager; the district office is at Haywards Heath. Salary: £2,170/£2,380 p.a. in accordance with Class C, Grade 5 of the N.J.M. and H.E. Scales. The district serves some 38,000 consumers over a mixed urban and rural area of 298 square miles. The successful applicant may be offered housing accommodation.

Applications, quoting ET and naming two referees, to the Mid-Sussex Manager, SeeBoard, Mid-Sussex Hse, North Rd, Brighton 1, in a "Confidential" envelope marked "Central Sussex District Manager," by 30 Aug., 1961.

ASSISTANT DISTRICT ENGINEER

GUILDFORD DISTRICT

Salary: £1,040/£1,165 under N.J.B. Class F, Grade 7. Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of M.V. and 11 kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ET, on forms from District Manager, Seeboard, Woodbridge Rd, Guildford, Surrey, by 30 Aug., 1961.

FIRST ASSISTANT DISTRICT ENGINEER

SUTTON DISTRICT

Salary: £1,275/£1,410 p.a., plus London allowance under N.J.B. G.5, with progression to Grade 4 (maximum £1,500) subject to satisfactory service. Superannuable. Applicants, with good technical qualifications, preferably with corporate or graduate membership of the I.E.E., must have had a wide experience in electricity supply distribution covering the planning, construction, operation and maintenance of H.V. and M.V. systems. The Sutton district (77,000 consumers) covers a dense urban area on the outskirts of London, and an engineer with considerable drive and initiative is required to progress a heavy reinforcement programme. Consideration will be given to a private car allowance and, in appropriate circumstances, to assistance with housing.

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Applications, quoting ET, on forms from District Manager, Seeboard, 52 High St, Sutton, Surrey, by 30 Aug., 1961.

DISTRICT COMMERCIAL ASSISTANT

HASTINGS DISTRICT

Salary: £700 x £25—£775 under N.J.C. Grade 2. Superannuable. The duties will consist mainly of estimating for contracting work but the successful candidate may also be engaged on sales in any of the district showrooms or at exhibitions, etc. Sound practical experience of wiring systems is an essential qualification, together with the ability to advise consumers on tariffs and the utilisation of electricity generally.

Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 12-13 York Bldgs, Hastings, by 30 Aug., 1961.

GEORGE WRAY,
Secretary.
(B 624)

SOUTH EASTERN GAS BOARD

ELECTRICAL ENGINEERING ASSISTANT

EAST GREENWICH

AN Electrical Engineering Assistant is required for the Board's East Greenwich Works to assist the Electrical Superintendent in operational control and supervision of plant installation and maintenance at the Station.

The East Greenwich site covers a large area and there is an extensive extra high tension and medium voltage distribution system with associated sub-station equipment. Alternating current motors are extensively used and there is mercury-arc rectifier equipment with d.c. motors for certain special duties. Power is supplied from a power station with an installed capacity of 6,500 kW equipped with condensing and pass-out steam turbo-alternator sets.

Applicants should therefore have practical industrial experience and technical knowledge in the installation and maintenance of such equipment on a large scale.

Possession of a Higher National Certificate or equivalent qualification in electrical engineering is desirable.

Salary within range £1,015/£1,220 according to qualifications and experience.

Applications in writing, quoting Reference V19/1536 and giving full details, should be sent to the Personnel Manager, South Eastern Gas Board, Katharine St, Croydon, within seven days. (B 623)

CJB

CONSTRUCTORS JOHN BROWN LIMITED

have several vacancies for

SUPERVISING ELECTRICAL ENGINEERS

Applicants should have served a recognised full apprenticeship with a reputable electrical contractor, be educated to a reasonable technical standard and have experience of large industrial and flameproof installations from estimating to final account stage.

The successful candidates would be required to reside on sites in the U.K. and abroad for periods of from one to two years. Good salaries and allowances.

Please apply in writing, giving details of age, experience and qualifications, to:

Personnel Manager,
CONSTRUCTORS JOHN BROWN LIMITED,
C.J.B. Hse, Eastbourne Terrace, Paddington, London W.2.

(B 575)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

ELECTRICAL ENGINEER'S DEPARTMENT

CROYDON DISTRICT

ENGINEERS

REQUIRED to join a District team commissioning major electrical plant in Generating and Transforming Substations in Surrey and maintaining automatic protective and control gear on such plant in that area.

Candidates must possess Higher National Certificate in Electrical Engineering or equivalent qualifications. The successful candidates will be required to live within approximately 10 miles of the District Headquarters at Croydon.

These positions offer good prospects to recently qualified engineers who are seeking a career in an interesting field.

The posts are designated Fourth Assistant Engineers (Technical). Salary range £940/£1,215 per annum including London Allowance. The Conditions of Service are as decided by the National Joint Board with generous holidays and Sick Pay Scheme and a contributory Superannuation Scheme.

Applications giving age, details of experience, qualifications, etc., should be sent to the Personnel Officer, Central Electricity Generating Board, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, to arrive by 21 Aug., 1961. (B 594)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

South Western Region

SHIFT CHARGE ENGINEER

COWES GENERATING STATION

APPLICANTS should have had previous experience in a generating station and preferably have had manufacturing works experience. Preference will be given to those possessing qualifications admitting to corporate membership of a recognised professional engineering institution.

Salary: N.J.B. E/7, Scale 7, £965/£1,090.

Special application forms, obtainable only from Divisional Secretary, Central Electricity Hse, High St, Portsmouth, should be returned by 31 Aug., 1961.

STATION CHEMIST

PORTSMOUTH GENERATING STATION

Applicants should have had practical experience of fuel, water and oil testing appropriate to a modern generating station and a knowledge of boiler chemistry for high steam pressures and temperatures will be an advantage. Preference will be given to candidates with Higher National Certificate in chemistry or with equivalent qualifications.

Salary: N.J.B. H/7, Scale 10, £1,190/£1,325.

Special application forms, obtainable only from Divisional Secretary, Central Electricity Hse, High St, Portsmouth, should be returned by 31 Aug., 1961. (B 626)

MINISTRY OF LABOUR

REQUIRES

PROFESSIONAL ELECTRICAL

ENGINEER (UNESTABLISHED)

at the Technical and Scientific Register, 28 King St, London S.W.1. Candidates should hold A.M.I.E.E. or degree or diploma in electrical engineering, with experience of heavy electrical engineering. Some knowledge of electronics an advantage. Duties: to assist in employment and advisory services for electrical engineers including correspondence and interviewing. Salary range £1,318/£1,547. Forms from above address quoting reference (K) D.410/1A. Closing date 31 Aug., 1961. (B 599)

LONDON ELECTRICITY BOARD

ENGINEERS (CONSTRUCTION)

APPLICATIONS are invited for the following appointments in the Construction Branch of the Chief Engineer's Department, at Lesco Hse, Stamford St, London S.E.1.

ENGINEER (CONSTRUCTION)

to supervise erection at various bulk supply substation sites within the Board's area, of heavy electrical plant, including transformers, switchgear, and auxiliary equipment, also supervision of laying, jointing and testing of underground cables. All this work is at voltages up to 66 kV. Applicants must have had previous experience of such work, both in the factory and on outside construction. A knowledge of the handling of cable contracts will be necessary.

Corporate membership of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers would be an advantage.

The post is graded under Schedule "A" of the National Joint Board Agreement, Class K (Area), as Grade 5, £1,475/£1,780 per annum, inclusive of London allowance (Ref.: PER/V/3384/T).

ENGINEERS (CONSTRUCTION) (TWO)

to assist in supervising the installation of electrical plant, including transformers, switchgear and cables at working pressures up to 66 kV together with all auxiliary equipment. Some previous experience in this work would be an advantage.

Applicants should possess at least a Higher National Certificate in electrical engineering.

The posts are graded under Schedule "A" of the National Joint Board Agreement, Class K (Area), as Grade 11, £950/£1,215 per annum, inclusive of London allowance (Ref.: PER/V/3385/T).

Application forms may be obtained from the Construction Engineer at the above address. (B 625)

Eastern Electricity

Fens Sub-Area

COMMERCIAL ASSISTANT

CAMBRIDGE BRANCH

168/61.R.

Candidates should be fully experienced in modern electrical installation practice and be able to prepare specifications and competitive quotations for domestic, commercial and industrial installations. The position offers the successful applicant a good opportunity to broaden his knowledge of commercial contracting work in a large Branch with both urban and rural characteristics.

Salary: N.J.C. Grade 3, £780/£880.

Applications in writing with full details should be addressed to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 1 Sept., 1961. (B 616)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

ELECTRICAL ENGINEER'S DEPARTMENT

NORTHFLEET

Vacancy Notice No. 147C/61.

THIRD OR FOURTH ASSISTANT ENGINEERS

(TECHNICAL)

CANDIDATES must possess Higher National Certificate in Electrical Engineering or equivalent qualifications and have had experience of the commissioning and maintenance of automatic protective gear and control gear of the type associated with major electrical plant in the Generating Board's Power Stations and Substations, and of investigating faults on such plant. Ability to make calculations of balanced and unbalanced fault conditions and to write a good report is also desirable.

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The appointment is offered at either Fourth Assistant Engineer level with a salary within the range £940/£1,215 per annum including London Allowance, with prospect of promotion subject to satisfactory service, or Third Assistant Engineer level with a salary within the range £1,180/£1,460 per annum including London Allowance, according to qualifications and experience.

The successful candidate will be required to live within approximately 10 miles of the District Headquarters at Northfleet.

Applications giving age, details of experience, qualifications, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 21 Aug., 1961. (B 595)

THE NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER

(POWER SALES

SUB-AREA COMMERCIAL DEPARTMENT

MANCHESTER

APPLICANTS should be qualified to advise consumers on the application of electricity to industrial processes especially in the Engineering, Chemical and Textile Industries. Some knowledge of space and process heating is desirable.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale: £1,535/£1,720 p.a. Grade M.7. N.J.B. conditions.

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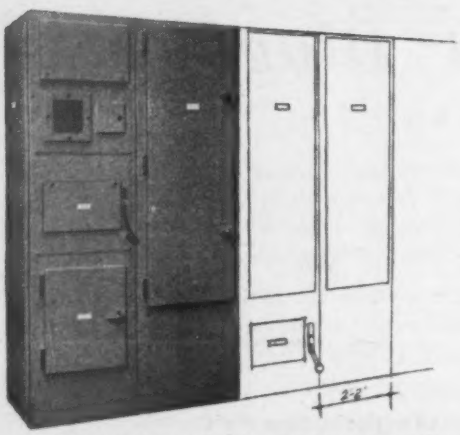

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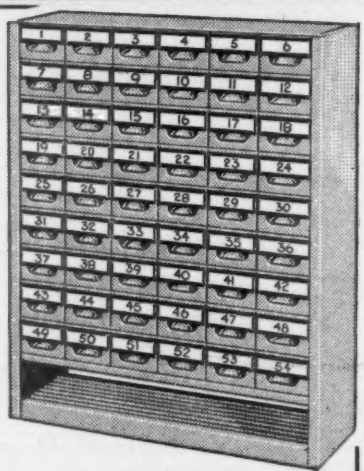

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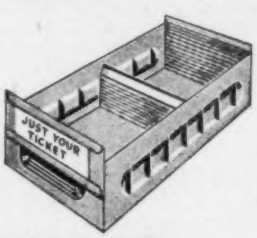

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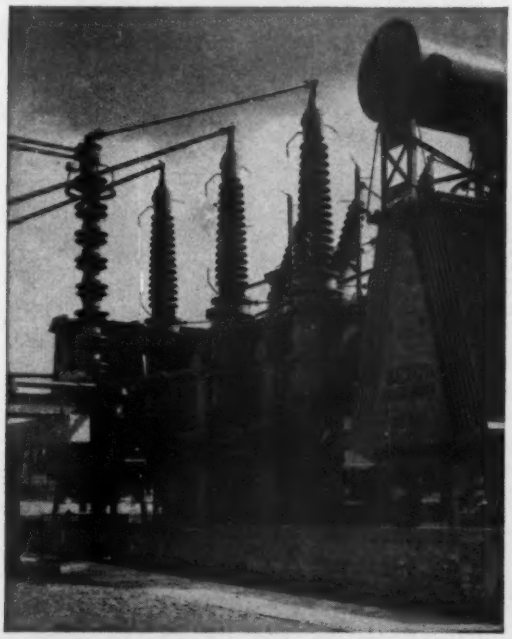

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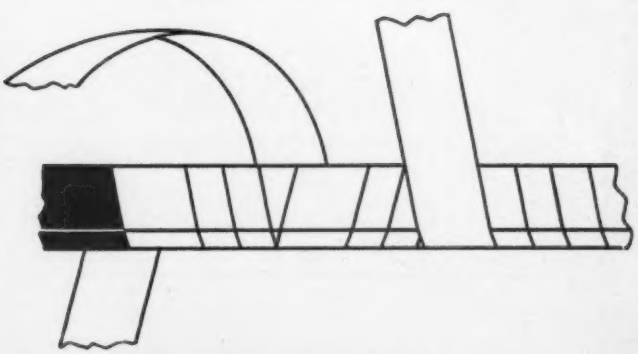

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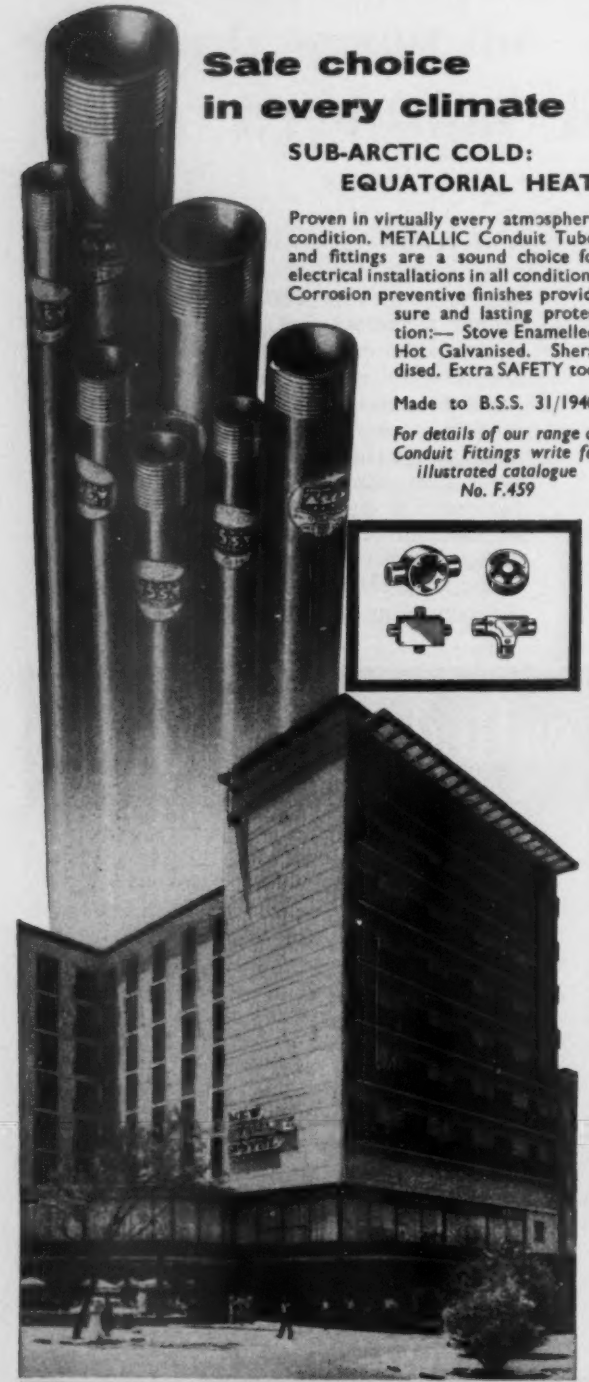

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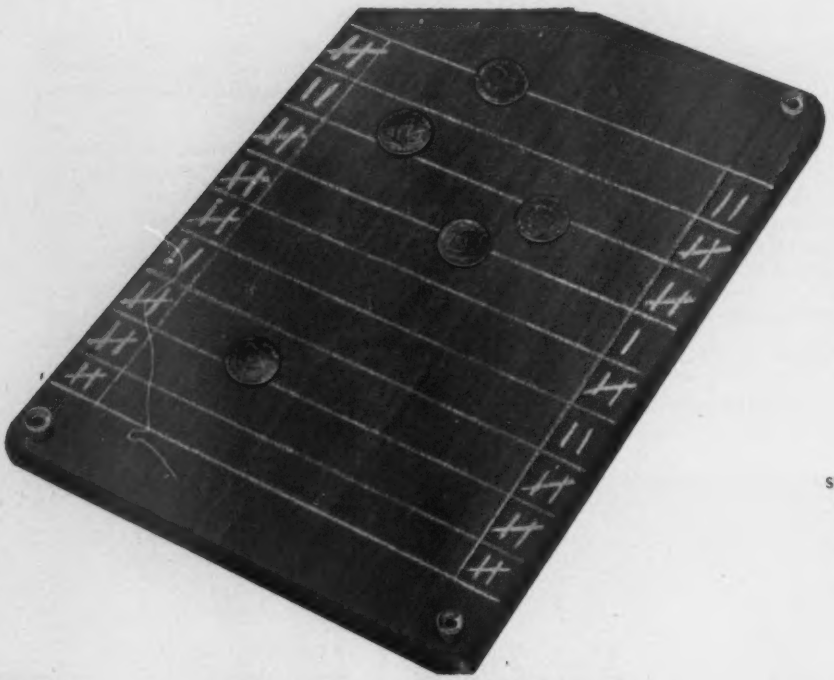

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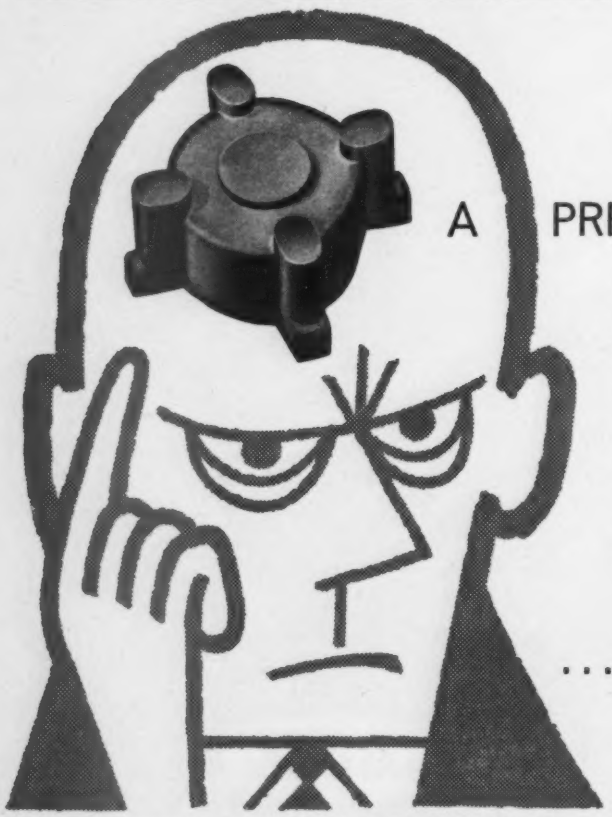

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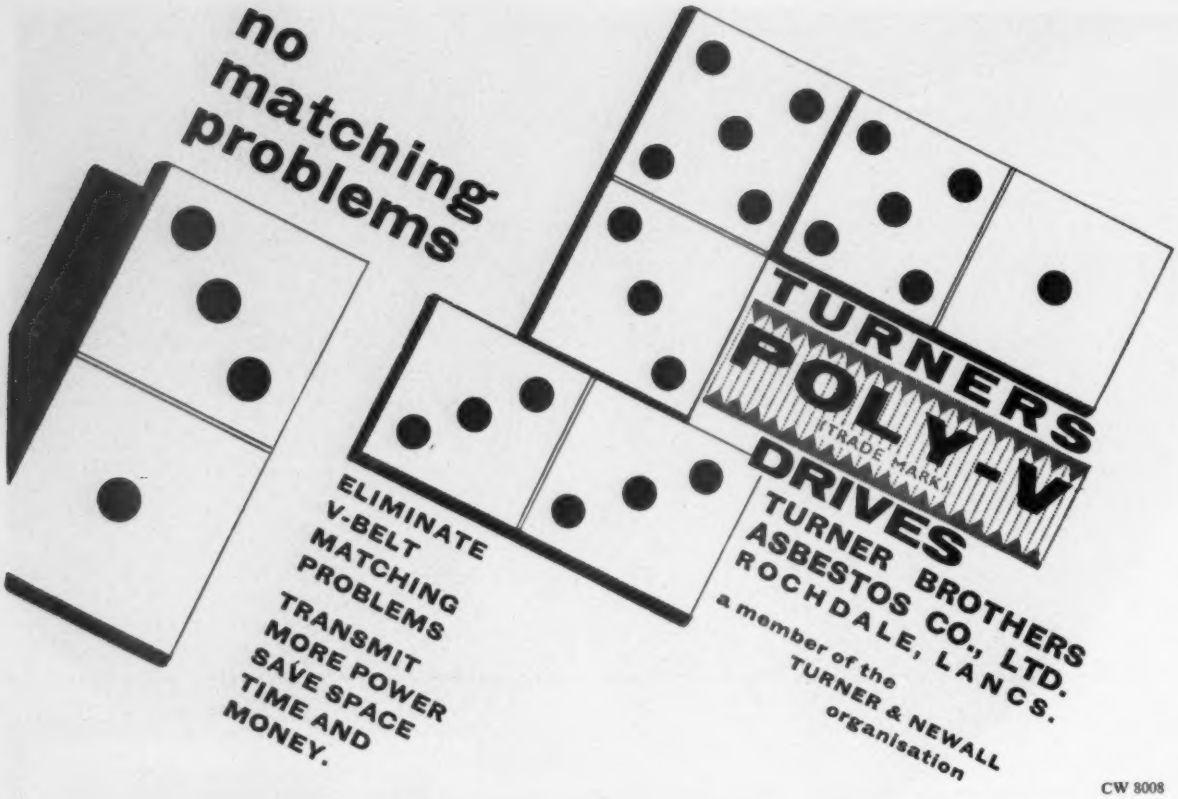

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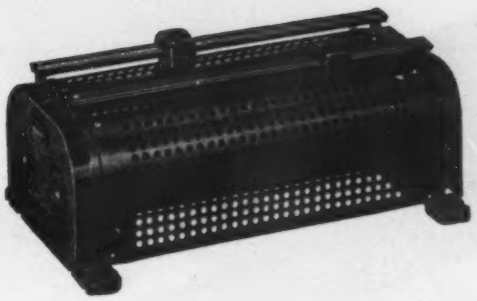

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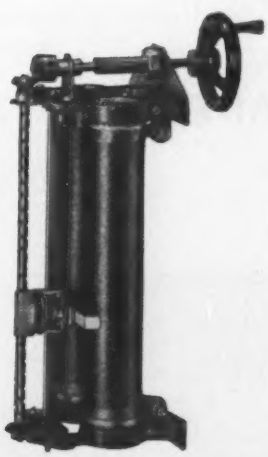

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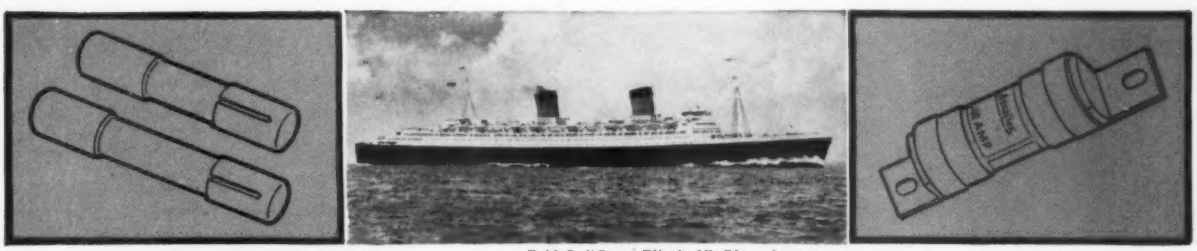

R.M.S. "Queen Elizabeth". Photo, by courtesy of The Cunard Steam-Ship Co. Ltd.

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